

8534 a. c.

T H E
Y O U N G A R I T H M E T I C I A N ' S
A S S I S T A N T,
O R,
The Scholar's Companion;
B E I N G A N
Abridgement of the Tutor's Guide.

I N F O U R P A R T S.

- I. Arithmetic, comprehending the most useful and familiar Rules.
- II. Vulgar Fractions in all their Parts.
- III. Decimal Fractions, with the Extraction of the Square and Cube Root. To which are added, Rules, for the easy Calculation of Interest, Annuities, &c.
- IV. Mensuration of Superficies and Solids, applied to the Measuring Artificer's Work, &c.

T O W H I C H A R E A D D E D,

Different Forms of Acquittances, Promissory Notes, Bills of Exchange, Bills of Parcels, &c.

The Whole designed for the USE of SCHOOLS in general, containing every Rule necessary for Young Gentlemen intended for Trade, &c.

By C H A R L E S V Y S E,
Author of the Tutor's Guide, &c. &c. &c.

L O N D O N,

Printed for G. Robinson, No. 25, Paternoster Row.

MDCCLXXXIV.

Explanation of the Characters made Use of in this Book.

Signs.	Names.	Significations.
+	Plus, or more,	The Sign of Addition, as $6+2$ is 8.
-	Minus, or less,	The Sign of Subtraction, as $6-2$ is 4.
$\times$	$\left\{ \begin{array}{l} \text{Multiplied} \\ \text{into, or by} \end{array} \right\}$	The Sign of Multiplication, as 6×2 is 12.
$\div$	Divide by.	The Sign of Division, as $6 \div 2$ is 3.
=	Equal to	The Sign of Equality, as $6+2=8$.
:	$\left\{ \begin{array}{l} \text{Is to} \\ \text{So is} \end{array} \right\}$	The Signs of Proportionals, as $2:4::6:12$.
$\sqrt{}$	$\left\{ \begin{array}{l} \text{Extraction} \\ \text{of the Roots.} \end{array} \right\}$	The Square Root of $9=3$ is $^2\sqrt{9}=3$, and the Cube Root of $8=2$ is $^3\sqrt{8}=2$.
$6-4 \times 9=18$; Signifies, that 6 less 4 multiplied by 9=18.		



T H E
P R E F A C E.

AS the primary Object in the Education of Youth is to ground them thoroughly in the first Principles of the various Branches of Learning, that of Arithmetic may justly claim the pre-eminence, being of general Use in all Parts of Life, even from the Merchant to the Shopkeeper; and nothing can have a Tendency to encourage the Pursuit of Youth after Learning with Chearfulness, more than easy and familiar Rules laid down for them to obtain this very desirable End. This has been attempted in the **TUTOR'S GUIDE**, a Book that many eminent Mathematicians and School-Masters have expressed their earnest Desires should be more generally made use of, as it contains a greater Variety of Matter, and more applicable to real Business, than any other Treatise on the same Subject, and so judiciously collected as to suit every Capacity; and by the Help of the **KEY**, Masters would be enabled to instruct ten Boys with more Ease to themselves, and greater Advantage to their Scholars, than they could accomplish in this Line of Education, to a single Pupil, by any other Book extant. But this being judged too expensive for young Beginners, they hitherto, particularly Masters of Day-Schools, have been under a Necessity of making use of a cheaper Book: therefore, to contribute as much as possible to the Ease of Masters in general, and Benefit of the Scholar, I have abridged the following Pages in such a Manner as to be an easy Purchase for the Use of every young Student, and have entituled it the **YOUNG ARITHMETICIAN'S ASSISTANT**, wherein every Rule necessary for the Information of Young Gentlemen designed for Trade, &c. is laid down with great Brevity,

P R E F A C E.

and partakes of the same Advantage respecting the **KEY** as the **GUIDE**; and the Author flatters himself will be found to answer the Purpose for which it is intended, by enabling the Masters of Boarding and other Schools, to furnish every Pupil (that learns Arithmetic) with this little Book, as it is well known by Experience that he will improve more by writing down his own Rules, than by always attending to the set Copies of others.—But it sometimes happens that Masters and Ushers, who write a fine Hand, are so pleased with their own Performances in that art, that they will not only pen down the Rules, but the Examples, also, which is a great Prejudice to the Scholar, and keeps him back from making that Proficiency he would otherwise have done, losing much Time in his Cyphering, by waiting for his Rules, being prepared for him, which too frequently is the Case, more especially in a numerous School, by which Means the Youth, when he enters upon real Business, scarce knows how to write a proper Receipt, or even to add up the Contents of a Bill with Propriety.—As soon as the Pupil has gone through the necessary Rules of this Book, I would recommend to him the **GUIDE**, as he will (by this Time) know how to make a proper Use of it; and when he quits the School, it would be adviseable for him to purchase the **KEY**; furnishing himself thereby with the completest System of Arithmetic now extant, and will enable him to attain a competent Knowledge of the different Rules with Ease and Precision. In order to make this little Book the more useful, different Forms of Acquittances, Promissory Notes, Bills of Exchange, Bills of Parcels, and Book-Debts, are added by the Author, who recommends to Youth the frequent copying of them as the surest Method of Improvement.

West Ham Abbey,
Jan. 14, 1784.

C. V.

T H E
Y O U N G A R I T H M E T I C I A N ' S
A S S I S T A N T .

B E I N G A N
Abridgement of the Tutor's Guide.

B O O K I .

Arithmetic in whole and compound Numbers.

I. I N T R O D U C T I O N .

 R I T H M E T I C is the Science, or Knowledge of Numbers, which is either Unit, or Multitude of Units.

Unit is any Thing considered as one, or 1.

Digits or Figures are the Marks by which Numbers are denoted or expressed, and are the nine following, viz. 1. 2. 3. 4. 5. 6. 7. 8. 9; with these there is used the Mark 0, called a Cypher, which of itself stands for nothing, but being annexed to the Right-hand of a Digit, alters its Value, thus 40 signifies forty, and 400 stands for four hundred, &c. (See the following Table.)

Integers or whole Numbers are such as express a Number or Multitude of Things, whereof each is considered as an Unit. Thus, 6 Pounds, 12 Yards, 140 Miles, &c. each of which is called an Integer, or whole Number.

Compound Numbers are such as consist of different Denominations, as Pounds, Shillings, Pence, and Farthings; or Hundreds, Quarters, Pounds, Ounces, &c.

Thus, 47*l.* 12*s.* 6*d.* or 4*C.* 2*qrs.* 14*lb.* &c.

A Fraction, or broken Number, is always less than Unit. as $\frac{3}{4}$ represents three Quarters of any Thing or Unit, and $\frac{6}{8}$, is six-eighths of Unit or 1, &c.

Arithmetic, with regard to Art and Science, consists both in Theory and Practice.

Theory considers the Nature and Quality of Numbers, and demonstrates the Reason of Practical Operations.

The Practice is that which shews the Method of working by Numbers, so as to be the most useful and expeditious for Business, and has five principal or fundamental Rules for the Operation, viz.

1. NUMERATION or NOTATION, 2. ADDITION, 3. SUBTRACTION, 4. MULTIPLICATION, and 5. DIVISION.

1. NUMERATION

TEACHETH to read, or express the true Value of any Number when writ down; and consequently to write down any proposed Number according to its true Value; and this consisteth of two Parts.

1. The due Order of placing down Figures,
2. The true valuing of each Figure in its Place, both of which are plainly exhibited in the following

T A B L E.

Hundred of Millions.	Tens of Millions.	Millions.	Hundred of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
9	8	7	6	5	4	3	2	1
4	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0
		4	0	0	0	0	0	0
			4	0	0	0	0	0
				4	0	0	0	0
					4	0	0	0
						4	0	0
							4	0
								4

E X A M P L E S.

Write down the Value of the following Numbers, in Words at length, viz. 94, 76, 762, 3024, 37460, 142613, 6040390, 47639121, 790401950, and 79041955.

In Figures exprefs

Seventy-seven. Four hundred and ninety. Six thousand and fifty-five. Seventeen thousand seven hundred and nine. Eight hundred thousand and two. Seven millions forty-four thousand and seventy-four. Six hundred. Ninety-four millions. Four hundred thousand and sixty.

N O T A T I O N.

By ROMAN Numerical Letters.

One, five, ten, fifty, hundred, five-hundred, thousand.

I, V, X, L, C, D, M.

When a less numerical Letter stands before a greater, it must be taken from it, as I, before V or X, and X before L or C, &c. Thus

four, nine, forty, ninety, &c.

IV, IX, XL, XC.

When a lesser numerical Letter stands after a greater, it is to be added to it. Thus.

six, eleven, sixty, one hundred and ten.

VI, XI, LX, CX.

A Line drawn over any Number less than a Thousand, signifies so many Thousands, as $\overline{LX}$, is sixty Thousand. $\overline{C}$ is one hundred Thousand, $\overline{M}$, is one Million, &c.

Write down in common Figures the following Numbers expressed in Numerical Letters, viz.

XIX, CC, DC, DLX, MI, MDCCL, $\overline{LXX}$, $\overline{CX}$, $\overline{MD}$, $\overline{MDC}$.

Write down in numerical Letters the following Numbers expressed in common Figures, viz.

29, 104, 419, 1741, 2007, 17678, 10004, 674084.

2. I N T E G E R S.

A D D I T I O N

TEACHETH to add sundry Numbers together into one Sum, called the Total.

R U L E.

1. Place all the Numbers of a like Name under one another, that is, units under units, tens under tens, hundreds under hundreds, &c.

2. Begin with the Units, and singly collect the Sum of each Row, and if their Sum be less than ten, set it down underneath its own place; but if it exceeds ten, the Excess is only to be set down, carrying one for every ten to the next Row, and so on, continuing to the last Row, at which set down the total Amount.

P R O O F.

Vary the adding, by beginning at the Top of the Sum, and reckon the Figures downwards, in the same Manner you added them upwards, and if the Sum comes the same as before, it is supposed to be right.

T A B L E of A D D I T I O N.

Which is to be got by Heart, by those who are Beginners in this Science.

0	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2		4	5	6	7	8	9	10	11
3	—		6	7	8	9	10	11	12
4	—	—		8	9	10	11	12	13
5	—	—	—		10	11	12	13	14
6	—	—	—	—		12	13	14	15
7	—	—	—	—	—		14	15	16
8	—	—	—	—	—	—		16	17
9	—	—	—	—	—	—	—		18

The manner of using the Table is thus: Take the greater of the two Digits, whose Sum is sought, in the upper Line, and the lesser on the left Hand Column, in the same Line with this, and underneath the other stands the Sum.

As suppose I wanted the Sum of 9 and 7, then I look for 9 on the Head of the Table, and in the same Line with 7 on the Side stands 16, the Sum.

EXAMPLES.

E X A M P L E S.

$$\begin{array}{r} (1) \quad 147279 \\ 274042 \\ 716914 \\ 472196 \\ 417417 \\ 194746 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (2) \quad 176042 \\ 47976 \\ 274 \\ 4 \\ 471472 \\ 469 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (3) \quad 127492 \\ 274614 \\ 27406 \\ 274 \\ 24 \\ 4158 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (4) \quad 147747 \\ 74774 \\ 2467 \\ 915 \\ 20 \\ 6 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (5) \quad 2147426 \\ 2749 \\ 275 \\ 3746 \\ 74 \\ 2147 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (6) \quad 174684 \\ 147129 \\ 2984 \\ 100 \\ 63 \\ 1074 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (7) \quad 174264 \\ 7416 \\ 271 \\ 147419 \\ 4176 \\ 47 \\ 7913 \\ 274 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (8) \quad 14768412 \\ 2131596 \\ 29418 \\ 274 \\ 71471041 \\ 219816 \\ 1427 \\ 70 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (9) \quad 174684 \\ 26276 \\ 174168 \\ 276 \\ 7 \\ 741705 \\ 27417 \\ 3570 \\ \hline \hline \end{array}$$

3. S U B T R A C T I O N

TEACHETH to take a lesser Number from a greater, and thereby shews the Difference or Remainder.

R U L E.

1. Place your Numbers according to the Direction given in Addition.

2. Begin at the Right-hand, and subtract each under Figure, from that which stands over it, writing each Remainder.

Subtraction.

mainder under which it proceeds from, so shall all the Remainder together express the Difference required.

3. But when the under Figure exceeds that which stands over it, you must borrow ten (the same which you stopped at in Addition) from which take the lower Figure, and to that Difference add the upper Figure and the Sum set down, always remembering to carry or add one to the next Figure on the Left-hand, before you subtract.

P R O O F.

To the lesser Number add the Remainder, if the Sum be like the greater the Work is right.

T A B L E of S U B T R A C T I O N.

0	1	2	3	4	5	6	7	8	9
1	0	1	2	3	4	5	6	7	8
2	—	0	1	2	3	4	5	6	7
3	—	—	0	1	2	3	4	5	6
4	—	—	—	0	1	2	3	4	5
5	—	—	—	—	0	1	2	3	4
6	—	—	—	—	—	0	1	2	3
7	—	—	—	—	—	—	0	1	2
8	—	—	—	—	—	—	—	0	1
9	—	—	—	—	—	—	—	—	0

The Manner of using this Table is the same with that of Addition, only, instead of adding the Digits together, subtract them.

E X A M P L E S.

(1) From 1472742
Take 1251620

Rem. _____

Proof _____

(2) 1704941
807467

(3) 17406542
16716746

(4) Bought 10768475
Sold 7607485

(5) 2074176
1760184

(6) 7417065
4708095

Rem. unfold _____

(7) From _____

Multiplication.

7

(7) From 10746142
Take 1786076

(8) 12468409
9147608

(9) 2170684
1100787

Rem.

(10) From 106742740
Take 74760946

(11) 214200040
107400760

4. MULTIPLICATION

TEACHETH how to increase any one Number by another, so often as there are Units in that Number by which the one is increased; and serves instead of many Additions.

To this Rule belong three principal Members, viz.

1. The Multiplicand, or Number to be increased, or multiplied.

2. The Multiplier, or Number by which the Multiplicand is increased, or multiplied.

3. The Product, or Number produced in multiplying.

Note. Before any Operation can be performed in this Rule, it is absolutely necessary that the following Table be got by heart; as the ready Performance of this and all the following Rules, entirely depends upon having a perfect Knowledge of it.

T A B L E.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

U S E

U S E of the T A B L E.

Seek the greater of the two Digits in the upper Line, and underneath it against the lesser, taken in the Left-hand Column, is the Product sought. Thus, to multiply 9 by 6, seek 9 in the upper Line, and under it against 6 on the left, is 54 the Product; and so of any other.

Note. For the Conveniency of dividing by 11 or 12, I have continued the Table to 12 Times, or else in Multiplication it is only required to 9 Times.

C A S E I.

To multiply by a single Figure.

R U L E.

1. Place the Multiplier underneath the Units Place of the Multiplicand.

2. Multiply the Units Figure of the Multiplicand by the Multiplier, if their Product be less than ten, set it down under its own Place of Units; but if their Product exceeds ten (or tens), then set down the Excess only (as in Addition) and bear (or carry) the said ten (or tens) in Mind, until you have multiplied the next Figure of the Multiplicand by the same Figure of the Multiplier, and to their Product add one for each ten borne in Mind, setting down the Excess of their Sum above ten (or tens) as before; and so proceed in the same Manner until all the Figures of the Multiplicand are multiplied by the Multiplier.

P R O O F.

The most sure and unerring Way is by Division. But as the Learner is supposed not yet to know that Rule, cannot prove by it; let him therefore make the Multiplicand the Multiplier, and if the Product comes out the same as before, the Work is right.

Some Masters that teach (and several Authors that write of) Arithmetic, prove Multiplication by the Cross. But this Method is not to be depended upon, as it will prove a Sum to be right, when at the same Time the Work is utterly false. But it will not prove a Sum false that is right.

Multiplication.

9

(1) Multiplicand 417609853
Multiplier 2

(2) 342719086
3

Product

(3) 257680914
4

(4) 174205683
5

(5) 170965381
6

(6) 749185603
7

(7) 262758094
8

(8) 37629845
9

C A S E II.

When the Multiplier consists of several Figures.

R U L E.

1. Place each Figure in the Multiplier respectively under its own Kind in the Multiplicand.

2. Multiply the Multiplicand, by each Figure of the Multiplier (as before), observing to place the first Figure of each respective Product underneath that Figure of the Multiplier, by which you multiply with.

3. Add the several Products together, and the Sum will be the desired (or whole) Product.

E X A M P L E S.

(9) 142737396
16

(10) 21607472
28

(11) 12076849
97

(12) 247567
475

(13) 317649
689

(14) 2706915
3746

(15) 147678
5682

(16) 47269
73581

(17) 73581
47269

10

Multiplication.

$$\begin{array}{r} (18) \quad 764258 \\ \quad 417396 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (19) \quad 417396 \\ \quad 764258 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (20) \quad 2719064 \\ \quad 5648736 \\ \hline \hline \end{array}$$

C A S E III.

When Cyphers are intermixed with the Figures in the Multiplier.

R U L E.

Omit them, and place the first Figure of each particular Product under its respective Multiplier.

E X A M P L E S.

$$\begin{array}{r} (21) \quad 10746047 \\ \quad 40500108 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (22) \quad 804700625 \\ \quad 207008009 \\ \hline \hline \end{array}$$

C A S E IV.

When there are Cyphers at the Right-hand of either, or both the Multiplier and Multiplicand.

R U L E.

Proceed as before, neglecting the Cyphers until the particular Products are added together, and to that Sum place the Number of Cyphers that are at the End of both Factors, on the Right-hand.

E X A M P L E S.

$$\begin{array}{r} (23) \quad 1460900 \\ \quad 8700 \\ \hline \hline \end{array}$$

$$\begin{array}{r} (24) \quad 2768000 \\ \quad 24600 \\ \hline \hline \end{array}$$

If it be required to multiply any Number by 10, 100, 1000, &c. it is only annexing the Cyphers of the Multiplier to the Right-hand of the Multiplicand, and the Work is done.

C A S E V.

When the Multiplier is such a Number that any two Figures (in the Table) being multiplied together will produce it.

R U L E.

Multiply the given Number by one of those Figures, and that Product by the other, which will give the desired Product.

EX-

E X A M P L E S.

(25) Multiply $\underline{24674}$ by 16. (26) Mul. $\underline{340764}$ by 28.

(27) Mul. $\underline{142395}$ by 56. (28) Mul. $\underline{176848}$ by 81.

(29) Mul. $\underline{420746}$ by 72. (30) Mul. $\underline{17093}$ by 63.

(31) Mul. $\underline{43074}$ by 144. (32) Mul. $\underline{14068}$ by 132.

C A S E VI.

When the Multiplier is any Number between 10 and 20.

R U L E.

Multiply by the Figure in the Units Place, and as you multiply, add to the Product of each single Figure, that of the Multiplicand, which stands next on the Right-hand.

E X A M P L E S.

(33) $\begin{array}{r} 142716 \\ 11 \\ \hline \end{array}$ (34) $\begin{array}{r} 14276 \\ 12 \\ \hline \end{array}$ (35) $\begin{array}{r} 146094 \\ 13 \\ \hline \end{array}$ (36) $\begin{array}{r} 24176 \\ 14 \\ \hline \end{array}$

(37) $\begin{array}{r} 36142 \\ 15 \\ \hline \end{array}$ (38) $\begin{array}{r} 176424 \\ 16 \\ \hline \end{array}$ (39) $\begin{array}{r} 14609 \\ 17 \\ \hline \end{array}$ (40) $\begin{array}{r} 18627 \\ 18 \\ \hline \end{array}$

(41) $\begin{array}{r} 142768 \\ 19 \\ \hline \end{array}$

5. D I V I S I O N

TEACHETH us to find how often one Number is contained in another, or to divide any Number or Quantity given, into any Parts assigned, and serves instead of many Subtractions. In this Rule there are three Numbers real, and a fourth accidental, viz.

1. The Dividend, or Number to be divided.
2. The Divisor, or Number by which you divide.
3. The Quotient, or Number that shews how often the Divisor is contained in the Dividend.

4. The

4. The Remainder, which is always less than what you divide by.

C A S E I.

When the Divisor is not greater than 12.

R U L E.

First seek how often the Divisor is contained in the first Figure of the Dividend, or if in Case the first Figure of the Dividend be less than the Divisor, then in the two first Figures of the Dividend, and set the Quotient Figure down accordingly, and if any Thing remains, carry it to the next Figure in the Dividend, where it must be reckoned as so many Tens, that is, if one remains you call it 10; if two, 20; if five, 50; and so on, bearing in mind the Remainder of each Figure, and adding it to the next, until you have made use of all the Figures in the Dividend. This is called short Division.

P R O O F.

Multiply the Quotient by the Divisor, and as you multiply, add the Remainder (if any) or add the whole Remainder to the Product at last, and if it comes the same as the Dividend, the Work is right.

E X A M P L E S.

(1) $2 \overline{)1742636.}$	(2) $3 \overline{)2764064.}$	(3) $4 \overline{)2160712.}$
(4) $5 \overline{)1076426.}$	(5) $6 \overline{)71420954.}$	(6) $7 \overline{)4674263.}$
(7) $8 \overline{)2768096.}$	(8) $9 \overline{)6768094.}$	(9) $11 \overline{)2762764.}$
(10) $12 \overline{)276484.}$		

C A S E II.

When the Divisor consists of many Places or Figures.

R U L E.

R U L E.

1. If the Divisor be a less Number than so many Figures taken in the Dividend, see how often the first Figure of the Divisor is contained in the first Figure of the Dividend, and the Figure which expresses it, is the first of the Quotient, by which multiply the Divisor, and place the Product under the said Figures of the Dividend, and draw a Line underneath it; subtract it therefrom, and to the Remainder annex the following Figure of the Dividend, then proceeding as before.

2. But if it happen that the Divisor be a greater Number than so many Figures of the Dividend, then you must take a Number of Places in the Dividend greater by one, and see how often the first Figure in the Divisor is contained in the two first of the Dividend, Allowance being made for what you carry from the Figure on the Right.

3. If in any Case the Remainder be so small that when the Figure of the Dividend joined with it, make a Sum less than the Divisor, then a Cypher is to be placed in the Quotient, and another Figure brought down, and then proceed as before; this is called Long Division.

E X A M P L E S.

- | | |
|------------------------|---------------------------|
| (11) 25)736473575(| (16) 7489)1204530760(|
| (12) 84)35730972(| (17) 42163)112737328(|
| (13) 648)272357640(| (18) 61745)392628787(|
| (14) 759)30891829676(| (19) 684573)3233238699(|
| (15) 3065)63463502247(| (20) 476085)98839054780(|
| | (21) 4728395)27750950255(|

C A S E III.

When the Divisor has Cyphers on the Right-Hand.

R U L E.

Strike off so many of the last Figures in the Dividend, and divide by those Figures of the Divisor that are left when the Cyphers are omitted. But when the Division is ended, those Cyphers so omitted in the Divisor, and the Figures cut off in the Dividend, are both to be restored to their own Places.

†

C

E X-

E X A M P L E S.

(22) $2800)11928248($ (23) $172000)247004674($

When the Dividend has the same Number of o's on the Right-hand as the Divisor, strike them off from each, and the Remainder will be so many of what you divide by, without annexing the o's that were struck off.

(24) $473000)351858000($ (25) $6970000)599430000($

C A S E IV.

When the Divisor is such a Number, that any two Figures (in the Multiplication Table) being multiplied together, will produce the said Divisor.

R U L E.

Divide the given Number by one of those Figures, and that Quotient again by the other, which will give the Quotient required.

Note. Observe, that if there be a Remainder in the last Division, it will be so many Times the first Divisor, which added to the first Remainder (if any) will give the true one.

E X A M P L E S.

(26) $\begin{array}{l} \text{Divide} \\ \left\{ \begin{array}{l} 1206816 \\ 42768 \\ 74682 \\ 14276 \end{array} \right\} \end{array}$ by $\left\{ \begin{array}{l} 16 \\ 48 \\ 72 \\ 144 \end{array} \right\}$ (30) $\begin{array}{l} \text{Divide} \\ \left\{ \begin{array}{l} 247684 \\ 14652 \\ 417681 \\ 307684 \end{array} \right\} \end{array}$ by $\left\{ \begin{array}{l} 28 \\ 64 \\ 81 \\ 132 \end{array} \right\}$

When the Learner is pretty well versed in Division he may subtract each Figure of the Product, as he produces it, and so only write the Remainder, which will shorten the Work, and be much the best Way, (when the Divisor is small.)

E X A M P L E S.

(34) $17)690489($ (36) $467)2148686($
 (35) $86)5343698($ (37) $6074)24939844($

TABLES of ENGLISH COINS.

Marked

q. $\left\{ \begin{array}{l} 4 \text{ Farthings} \\ 12 \text{ Pence} \\ 20 \text{ Shillings} \end{array} \right\}$ are one $\left\{ \begin{array}{l} \text{Penny.} \\ \text{Shilling.} \\ \text{Pound, } \text{£.} \end{array} \right\}$

$\left\{ \begin{array}{l} \frac{1}{4} \\ \frac{1}{2} \\ \frac{3}{4} \end{array} \right\}$ is wrote for $\left\{ \begin{array}{l} q. \\ 1 \\ 2 \\ 3 \end{array} \right\}$

PENCE

PENCE TABLE.

d.	s.	d.	d.	s.
20	1	8	24	2
30	2	6	36	3
40	3	4	48	4
50	4	2	60	5
60	5	0	72	6
70	5	10	84	7
80	6	8	96	8
90	7	6	108	9
100	8	4	120	10
110	9	2	132	11
120	10	0	144	12

The WEIGHTS and VALUE of such GOLD and SILVER COINS, as are most commonly used in ENGLAND.

	Weight.			Value.		
	d.	wt.	gr.	l.	s.	d.
A Guinea	5	9	9	1	1	0
Half ditto	2	16	14	0	10	6
A Quarter ditto	1	8	7	0	5	3

S I L V E R.

A Crown	19	8	10 ³ / ₄	0	5	0
Half ditto	9	16	5 ¹ / ₂	0	2	6
A Shilling	3	20	18	0	1	0
A Six-pence	1	22	9	0	0	6

Note. 20 Mites make one Grain.

N. B. Besides the above Coins, we have had Portugal Money in use here, the Value and Weight of which are as follows.

	l.	s.	d.		d.	wt.	gr.
A Piece of	3	12	0	should weigh	18	16	
Ditto of	1	16	0		9	6	
Ditto of	0	18	0		4	15	
Ditto of	0	9	0		2	7 ¹ / ₂	
A Moidore	1	7	0		6	18	
Half ditto	0	13	6		3	9	
Quarter ditto	0	6	9		1	16 ¹ / ₂	

C 2

A Pound

A Pound Weight Avoirdupoise of Copper, is coined into twenty-three Pence; consequently a Half-penny is one-third of an Ounce nearly; and a Farthing one sixth.

	s.	d.		
Note.	6	8	} are one	{ Noble.
	10	0		
	13	4		
				{ Angel.
				{ Mark.

6. R E D U C T I O N

TEAChETH to reduce all great Names into small, by multiplying the given Number with so many of the next lower Name, as to make one of the higher, still keeping them equivalent in Value, and is called Reduction descending; on the contrary, all small Names are brought into great, by dividing the given Number by so many of the lesser Name as make one of the next greater; this is the Converse of the last, and is termed Reduction ascending.

EXAMPLES in MONEY.

1. In 27/. how many Shillings and Pence?
2. Reduce 648⁰d. to Shillings and Pounds.
3. How many Shillings, Pence, and Farthings, are there in 40l. 10s.?
4. In 38880 Qrs. how many Pounds?
5. Reduce 104l. 17s. 6¹/₂d. to Farthings.
6. How many Pounds in 100683 Qrs.?
7. In 21 Guineas, how many Shillings, Pence, and Farthings?
8. Reduce 21168 Farthings to Guineas.
9. In 42 Moidores how many Farthings?
10. How many Moidores in 54432 Farthings?

WEIGHTS and MEASURES.

TROY WEIGHT.

Marked			
gr.	24 Grains	} are one	{ Penny Weight.
cwts	20 Penny Weights		
oz.	12 Ounces		
			{ Ounce.
			{ Pound. 16.

By

By Troy Weight is weighed Gold, Silver, Jewels, Amber, Bread, Corn, and all Liquors, and from this Weight all Measures for wet and dry Commodities are taken.

N. B. 14 oz. 11 dwts. $15\frac{1}{2}$ grs. Troy, is equal to 1 Pound Avoirdupoise.

E X A M P L E S.

1. In 24 lb. of Silver, how many Ounces, Penny Weights, and Grains?
2. Reduce 138240 grs. to dwts. oz. and lb.
3. In an Ingot of Silver weighing 12 lb. 10 oz. 22 grs. how many Grains?
4. Reduce 73942 grs. to Pounds.

A P O T H E C A R I E S W E I G H T S.

Marked

grs.	20 Grains	} are one {	Scruple.
℥	3 Scruples		Dram.
ʒ	8 Drams		Ounce.
℔	12 Ounces		Pound, ℔.

Apothecaries, in making up their Medicines, use this Weight, but they buy and sell their Drugs by the Avoirdupoise Weight.

E X A M P L E S.

5. In 14 lb. how many Ounces, Drams, Scruples, and Grains?
6. Reduce 80640 grs. to ℥, ʒ, ʒ, and ℔.
7. How many Grains, 4 ℔, 11 ʒ, 2 ℥, 17 grs.?
8. In 28377 grs. how many Pounds?

A V O I R D U P O I S E W E I G H T.

Marked

dr.	16 Drams	} are one {	Ounce.
oz.	16 Ounces		Pound.
lb.	28 Pounds		Quart. of Cwt.
qr.	4 Quarters or 112 lb.		Hundred.
cwt.	20 Hundred		Ton.

By Avoirdupoise Weight is weighed all Manner of Things that have Wasse, as all Physick Drugs and Grocery, Rosin, Wax, Pitch, Tar, Tallow, Soap, Hemp, Flax, Hay, Wool, &c. All base Metal and Minerals, as Iron, Steel, Lead, Tin, Copper, Alum, Copperas, &c. Also Bread, Butter, Cheese, Salt, Butcher's Meat, &c.

The Denominations in some of which are as follow, viz.

8 Pounds	} are one	{	Stone of Butcher's Meat.
14 Pounds			Stone of Horseman's Weight.
19½ Hundreds			Fodder of Lead.

W O O L W E I G H T.

7 Pounds	} are one	{	Clove.		6½ Todds	} are one	{	Wey.
2 Cloves			Stone.		2 Weys			Sack.
2 Stones			Todd.		12 Sacks			Last.

H A Y

BREAD.

Weight.

56 Pounds of old Hay, or	} are		Peck Loaf	17	6	1	
60 Pounds of new ditto			1 Truss	Half ditto	8	11	0½
36 Trusses			are 1 Load	Quartern d°.	4	5	8¼

Note. There are some Sorts of Silk which are weighed by a great Pound of 24 oz.

E X A M P L E S.

9. In 1 Ton, or 20 Cwt. how many Quarters, Pounds, Ounces, and Drams?
10. Reduce 573440 drs. to Hundreds, &c.
11. Reduce 27 lb 12 oz. 11 drs. to Drams.
12. How many Pounds in 7115 drs.?
13. In 12 Tons, 10 cwt. 14 lb. 11 oz. 15 drs. how many drs.?
14. How many Tons are there in 7171775 drs.?

C L O T H M E A S U R E.

4 Nails	} are one	{	Quarter of a Yard		Marked.
3 Quarters			Ell Flemish		na. qrs.
4 Quarters			Yard		Ell Fl.
5 Quarters			Ell English		Yd.
6 Quarters			Ell French		Ell Eng.
					Ell Fr.

Scotch

Scotch and Irish Linens are bought and sold by the Yard, but Dutch Linens, are bought by the Ell Flemish, and sold by the Ell English.

E X A M P L E S.

15. In a Piece of Cloth containing 24 Yards, how many Quarters and Nails?
16. Reduce 384 Nails to Yards.
17. How many Nails are there in 72 Ells Eng. 4 qrs. 2 na.?
18. Reduce 1458 Nails to Ells English.
19. In 121 Ells Flemish, how many Nails?
20. Reduce 1452 Nails to Ells Flemish.
21. How many Nails in 42 Ells Fr. 5 qrs.?
22. Reduce 1028 Nails to Ells French.

L O N G M E A S U R E.

Marked

b. c.	3	Barley Corns	} are one	[Inch.
in	12	Inches		[Foot.
f.	3	Feet or 36 Inches		[Yard.
yd.	2	Yards or 6 Feet		[Fathom.
	5½	Yards or 11 half-yds.		[Pole, Rod or Perch.
p.	40	Poles or 220 Yards	} are one	[Furlong.
fur.	8	Furlongs, or 1760 yds.		[Mile.
m.	3	Miles		[League.
lea.	23½	Leagues or 69½ Miles	} are one	[Degree, Deg.
	360	Degrees are the Circumference of the Globe.		

360 Degrees are the Circumference of the Globe.

5 Feet is a Geometrical Pace.

16½ Feet is a Pole.

A L S O

4	Inches	} are one	[Hand or Hand's Breadth.
3	Hands Breadth		[Foot.
1½	Foot		[Cubit.
2	Cubits		[Yard.

By this Measure, Distances of Places, or any Thing else, that has Length only, are measured.

E X A M P L E S.

23. In 176m. 30p. how many Poles?
24. Reduce 56350 Poles to Miles.

25. How

25. How many Yards, Feet and Inches, are there in 200 Miles?
 26. In 12672000 Inches, how many Miles?
 27. Reduce 12 Leag. 1 M. 6 Fur. 29 P. 4 Yds. to Barley Corns.
 28. In 7193178 h. c. how many Leagues, &c.

L A N D M E A S U R E.

Marked

p.	5 $\frac{1}{2}$ Yards	} are one	{ Perch, Rood, or Pole.
r.	40 Poles		{ Rood.
r.	4 Roods		{ Acre.
a.	30 Acres		{ Yard of Land.
	100 Acres		{ Hide of Land.

The best Way of measuring Land, is by a Chain of 4 Poles, or 66 Feet long, which is divided in 100 equal Parts called Links.

In. b.c.		} are one	{ Link.
7	276		{ Pole.
25	Links		{ Chain.
4	Poles or 100 Links or 22 Yards.		{ Furlong.
10	Chains		

E X A M P L E S.

29. In 42 Acres, how many Roods and Poles?
 30. Reduce 6720 Poles to Acre.
 31. In 12A. 3R. 29P. how many Poles?
 32. How many Acres in 2069 Perches?

W I N E M E A S U R E.

Marked

pt.	2 Pints	} are one	{ Quart.
qt.	4 Quarts or 8 Pints		{ Gallon.
gall.	10 Gallons		{ Anchor of Br. or R.
	18 Gallons		{ Runlet.
	31 $\frac{1}{2}$ Gallons		{ Barrel.
	42 Gallons		{ Tierce.
tier.	2 Tierce, or 84 Gallons		{ Punccheon, Punch.
	63 Gallons		{ Hoghead.
h.	2 Hogheads or 126 Gal.		{ Pipe or Butt.
p.	2 Pipes or 252 Gal.		{ Tun.

Note.

Note. A Tun of Wine is 18 Cwt. Avoirdupoise.

A Gallon is 231 solid Inches.

By Wine Measure, all Spirits, Mead, Perry, Cyder, Vinegar, Oil, and Honey, &c. are measured; as also Milk, not by Law, but Custom only.

EXAMPLES.

33. In 4 Anchors of Brandy, how many Gallons and Quarts?
34. In 160 Quarts, how many Anchors?
35. Reduce 4 hhds, of Wine to Gallons and Pints.
36. How many Hogsheads of Wine is in 2016 Pints?
37. Reduce 42 Tierces and 24 Gallons to Pints.
38. How many Tierces in 14304 Pints?
39. In 1 Tuns, 1 p. 1 hhd. 42 gal. 6 pts. how many Pints?
40. Reduce 9918 Pints to Tuns, &c.

WINCHESTER MEASURE.

Called also Ale and Beer Measure.

Marked

pts.	2 Pints	} are one	{	Quart.
qts.	4 Quarts or 8 Pints			Gallon.
gal.	8 Gallons A'e, or			Firkin.
	9 Gallons Beer	} or	{	Gal. Kilderkin.
fi.	2 Firkins			
kil.	2 Kilderkins, or			
	4 Firkins	} or	{	32 Ale } are 1 Barrel.
bar.	1½ Barrel, or			36 Beer }
	3 Kilderkins			48 Ale } are 1 Hoghead.
		} or	{	54 Beer }
hhds.	2 Hogsheads or 3 Bar. or 108 Ga.			
	2 Butts or 216 Gallons			

Note. 8½ Gallons is a Firkin of Beer or Ale in all Parts of England except London.

A Gallon of Ale or Beer is 282 solid Inches.

A Firkin of Soap or Herrings is the same with that of Ale.

EXAMPLES.

41. In 12 Barrels of Ale, how many Gallons and Quarts.
42. Reduce 1536 Quarts of Ale to Barrels.

43. In

43. In 42 Barrels of Beer, how many Pints?
 44. Reduce 12096 Pints of Beer, to Barrels.
 45. In 6 hhds. 27 gal. 6 pts. of Ale, how many pts?
 46. How many hhds. of Ale in 2526 p's?
 47. How many gal. and pts. in 14 hhds. 47 Gal. of Beer?
 48. Reduce 6424 Pints of Beer to Hogheads.
 49. Reduce 6 Tuns, 1 Butt, 42 Gal. of Beer to Quarts.
 50. How many Tuns, &c. in 5784 Quarts of Beer?

D R Y M E A S U R E,

Marked			
pts.	2 Pints	} are one {	Quart.
qts.	4 Quarts or 8 Pints		Gallon.
gal.	2 Gallons		Peck.
pks.	4 Pecks or 8 Gallons		Bushel.
bu.	4 Bushels		Comb.
c.	2 Combs or 8 Bushels		Quarter.
qrs.	5 Quarters	}	Wey.
	2 Weys or 10 Quarters		Last.

A L S O,

4 Quarters or 32 bu. } are one { Chaldron } of Corn.
 2 Bushels } Strike }

A Load of Corn is 5 Bushels.

A Cart Load of ditto is 40 Bushels.

2 Quarts are one Pottle, both in Liquid and Dry Measure.

A Gallon contains $268\frac{4}{5}$ solid Inches.

In measuring Sea Coal,

5 Pecks is one Bushel, Water Measure.

3 Bushels	} are one {	Sack.
9 Bushels		Vatt.
36 Bushels, or		Chaldron.
12 Sacks		Score.
21 Chaldrons		

By Dry Measure, Corn, Salt, Coals, and all other Dry Goods are measured.

The standard Bushel is $18\frac{1}{2}$ Inches wide, and 8 Inches deep.

E X A M P L E S.

51. In 24 Quarters of Corn, how many Bushels, Pecks, Gallons, and Quarts?

52. How

52. How many Quarters of Corn in 6144 qts.?
 53. Reduce 36 chs. 26 bu. of Coals to Pecks.
 54. How many Chaldrons of Coals in 5288 Pecks.?
 55. In 64 Lasts of Corn, how many Weys, bu. and pks?
 56. How many Lasts in 20480 Pecks.

T I M E.

*Time of itself is noibing, but from Thought
 Receives its Rise, by labouring Fancy wrought;
 From Things consider'd whilst we think on some,
 As present, some as past, or yet to come:
 No Thought can think on Time, that's still confest,
 But thinks on Things, in Motion or at Rest.*

Marked	///	60 Thirds	} are one	Second.
sec.		60 Seconds		Minute.
m.		60 Minutes		Hour.
h.		24 Hours		Day.
d.		7 Days		Week.
w.		4 Weeks, or 28 Days		Month.
mo.		52 Weeks, 1 Day, 6 Hours or	} are one	Year Julian.
		13 Months, 1 Day, 6 Hour, or		
		365 Days, 6 Hours		
365 Days, 5 Hours, 48 Minutes, 57 Seconds, 39 Thirds are a Solar Year.				

The Year is also divided in 12 unequal Calendar Months called,

January, February, March, April, May, June, July, August, September, October, November, December.

And to know how many Days are in each Month, observe (to get by Heart) the following Lines.

*Thirty Days hath September,
 April, June, and November:
 February hath twenty-eight alone,
 And all the Rest hath thirty-one;
 Except Leap-Year, and then's the Time,
 February's Days are twenty-nine.*

EXAMPLES.

E X A M P L E S.

57. How many Hours, Minutes and Seconds, are there in a Week or 7 Days?
 58. In 604800 Seconds, how many Days?
 59. Reduce 6 mo. 4 d. to sec.
 60. In 14860800 sec. how many Months?
 61. How many Seconds are there in a Julian Year, or in 365 Days, 6 Hours?
 62. In 31557600 sec. how many Days?
 63. How many Thirds are there in a Solar, Year, or in 365 Days, 5 Hours, 48 Minutes, 57 Seconds, and 39 Thirds?
 64. Reduce 1893416259 Thirds, to Days.

SQUARE or SUPERFICIAL MEASURE.

144	Square Inches	} are one {	Square Foot.
9	Feet		Yard.
30 $\frac{1}{4}$	Yards		Pole.
40	Poles		Rood.
4	Roods		Acre.
640	Acres or		Mile.
4840	Yards		

272 $\frac{1}{4}$ Feet, is one Rod of Brick Work.

100 Square Feet is one Square of Flooring.

By this Measure are measured all Things in which Length and Breadth is only considered.

E X A M P L E S.

65. In 42 Square Yards, how many Square Inches?
 66. How many Square Yards in 54432 Square Inches?
 67. Reduce 3 sq. 42 Feet, 64 in. of Flooring to Inches.
 68. How many Squares are there in 49312 sq. Inches?

CUBIC or SOLID MEASURE.

1728	Solid Inches	} are one {	Solid Foot.
27	Feet		Yard.
40	Feet of round Timber, or		Ton or Load.
50	Feet of hewn Timber		

A Solid Yard of Earth is called a Load.

108 Solid

108 Solid Feet (i. e.) 12 Feet long, 3 Feet broad, and 3 Feet deep, or commonly 14 Feet long, 3 Feet 1 Inch broad, and 3 Feet 1 Inch deep. is a Stack of Wood; 128 solid Feet, i. e. 8 Feet long, 4 Feet broad, and 4 deep is a Cord of Wood.

By this Measure are measured all Things in which are considered Length, Breadth, and Depth or Thickness.

E X A M P L E S.

69. In 27 solid Yards, how many solid Inches?
 70. Reduce 1259712 solid Inches, to solid Yards.
 71. How many solid Inches are there in 4 Tons 24 Feet of hewn Timber?
 72. In 387072 solid Inches, how many Tons of hewn Timber?

Of some Particular WARES or GOGDS.

12	} are one {	Dozen.
12 Dozen		Gross.
12 Gross		Great Gross.
20		Score.
5 Score		Hundred.
6 Score, or 120	}	Great Hundred.
1200		Thousand.

E N D O F B O O K I.

T H E
YOUNG ARITHMETICIAN'S
A S S I S T A N T.

B O O K II.

E X E R C I S E in N U M E R A T I O N.

IN Figures express the following Number, viz.

1. One Million and a Half in South Sea Bonds.
2. Threescore and twelve Thousand thirteen Hundred Weight of Lead.
3. Fifteen Thousand and fourscore Million of Stivers.
4. One Hundred and twenty Thousand two Hundred and sixty Millions seventy Thousand seven Hundred and seven Rials of Plate.
5. Three Million and thirty-three Thousand and thirty Pieces of Eight.
6. Four Hundred Thousand and forty Hundred Pounds, thirty-four Shillings, and fourteen Pence, five Farthings.

A D D I T I O N.

E X A M P L E S of I N T E G E R S.

1. Add the following Numbers, viz. 140724, 296, 42, 6740, 4167, 20, 2687, and 2684 together.
2. Add 27460, 176, 2900, 274, 1004, 64, 596, 41, and 6104 together.
3. Add 867, 317, 69, 1720, 276842, 49, 426074, and 60 together.

7. COM.

7. COMPOUND ADDITION.

TEACHETH to add sundry Sums or Numbers together, having divers Denominations, as in Money, Weights, Measures, &c.

R U L E.

1. Place the Numbers of a like Denomination under each other, viz. Pounds under Pounds, Shillings under Shillings, Pence under Pence, Farthings under Farthings, &c.

2. Begin to add, at the lowest Denomination first, as in Integers, then divide that Sum by as many of the same Denomination, as make one of the next greater, setting down the Remainder under the Row added, and carry the Quotient to the next superior or greater Denomination, whose Sum you must also find; proceed in this Manner to the last (or greatest Denomination) which add as Integers.

E X A M P L E S of M O N E Y.

£.	s.	d.
(1) 4	17	11½
2	6	4
1	19	10¾
3	11	6½
8	17	9
1	4	0
6	0	11¾
5	12	6
2	8	11½

£.	s.	d.
(2) 14	11	6
27	16	11½
41	17	7
56	6	4¼
17	11	11½
47	6	4
0	10	6
4	0	0
17	17	6¾

£.	s.	d.
(3) 127	11	10½
41	17	6
100	0	0
52	10	11¾
116	12	6
24	19	11½
6	6	0
0	10	6
2	2	0

(4) Add 27*ol.* 16*s.* 6½*d.* 6*ol.* 10¾*d.* 6*ol.* 10*s.* ¾*d.* 96*l.* 6*s.* 10*d.* 176*l.* 6*s.* 6½*d.* 2*l.* 2*s.* 16*l.* 17*s.* 6½*d.* and 100*l.* into one Sum.

(5) Add 26*ol.* 17*s.* 67*l.* 10*s.* 10¾*d.* 17*ol.* 10*s.* ½*d.* 100*l.* 10*s.* 6¼*d.* 4*l.* 16*s.* 6½*d.* 19*s.* ¾*d.* 37*l.* 11*s.* 11½*d.* 60*ol.* 10*s.* and 22*ol.* 6½*d.* into one Sum.

(6) Add 276*l.* 17*s.* 16*l.* 10¾*d.* 269*l.* 11*s.* 11½*d.* 107*l.* 19*s.* 10*l.* 6*d.* 14*s.* 11*d.* 367*l.* 17*s.* 6¾*d.* 12*s.* 4½*d.* 20*l.* 10*s.* 6*d.* and 1000*l.* into one Sum.

OF WEIGHTS and MEASURE.

oz. drs. grs.	lb oz. drs. grs.	3 3 3 grs.
(1) 27 11 20	(2) 27 10 17 11	(3) 11 2 1 17
17 14 21	11 11 19 6	7 4 2 14
46 17 11	4 6 14 17	4 1 1 17
27 14 6	27 10 17 23	2 5 2 11
4 9 17	17 7 11 17	10 1 2 16
17 19 22	6 4 0 16	14 7 1 13
27 17 16	17 11 18 15	11 4 2 11

lb 3 3 3 grs.	Tons. C. qr. lb.
(4) 14 11 4 2 11	(5) 14 17 2 14
11 2 1 1 17	417 11 1 21
4 10 2 2 16	24 6 3 27
17 4 7 1 4	219 14 1 14
5 11 0 2 11	36 17 2 26
17 10 1 1 14	11 14 1 14
14 6 4 2 15	6 11 2 19

lb. oz. drs.	yds. qrs. na.	Eng. Ells. qrs. na.
(6) 14 11 14	(7) 14 2 3	(8) 12 4 2
17 14 11	276 1 0	27 0 0
5 6 12	37 3 2	42 2 3
21 4 15	4 1 1	176 3 2
36 13 11	110 0 0	94 1 3
14 7 10	17 3 2	62 2 1
6 11 6	13 2 3	142 1 2
4 4 12	106 1 2	41 2 3

El. Ells. qrs. na.	lea m. fur. p.	yds. f. in. b. c.
(9) 17 2 1	(10) 12 1 7 14	(11) 141 2 11 2
42 1 2	27 1 4 27	27 1 4 1
146 2 1	141 2 6 36	214 2 10 2
64 1 3	84 0 7 39	76 0 11 0
72 2 1	100 1 4 11	217 2 4 2
87 1 2	36 2 5 13	96 1 11 1
100 0 0	4 0 0 24	140 2 0 0
43 2 3	120 2 6 6	60 0 10 1

Addition:

29

A. r. p.
(12) 210 2 27
74 3 14
142 1 37
47 2 14
149 0 27
34 3 36
8 1 11

tuns.p.bds.ga.qts.
(13) 12 1 1 14 2
14 1 1 27 3
10 1 0 61 1
6 1 1 42 2
2 0 0 26 3
13 1 1 4 2
6 0 0 36 3

punch.gal.qt.pt.
(14) 14 14 2 1
7 32 3 1
24 51 2 1
14 14 1 1
49 36 3 1
37 17 1 1
8 62 3 1

tier. gal. pts.
(15) 12 24 7
41 41 4
3 26 2
0 14 5
27 39 6
19 14 4
21 34 3

anch.gal.pts.
(16) 10 7 4
14 9 7
27 4 2
4 6 0
11 5 3
2 3 5
17 2 6

A.bds.gal.qts.
(17) 14 12 2
6 41 3
17 27 1
8 34 2
47 40 3
4 27 1
18 11 0

B.bds.gal.pts.
(18) 24 51 7
14 17 4
6 8 6
14 12 0
9 47 4
34 36 5
17 11 2
4 29 7

A.bar.kil.fir.ga.pts.
(19) 14 1 1 4 7
27 1 0 7 4
19 1 1 6 5
6 0 1 5 3
31 1 0 3 2
6 0 1 1 6
10 1 1 4 3
6 1 0 6 0

B.fir.gal.qrs.pt.
(20) 14 8 2 1
9 7 1 0
10 4 3 1
6 6 2 1
27 5 1 0
8 2 3 1
41 1 0 1
6 3 1 1

qrs.bu.p.gal.
(21) 14 7 2 0
27 4 3 1
142 6 1 1
19 4 2 0
4 6 3 1
127 4 1 0
41 1 2 1

cha. bu. p.
(22) 12 27 2
21 0 0
6 31 3
45 27 1
36 19 2
7 24 3
12 12 2

la.w.qrs.bu.p.
(23) 11 1 4 7 3
14 1 2 4 1
7 1 3 4 2
10 0 2 6 1
6 1 1 4 2
17 1 2 5 0
8 1 4 0 3

	<i>mo.</i>	<i>w.</i>	<i>d.</i>	<i>h.</i>
(24)	11	2	4	21
	24	3	6	14
	12	1	0	23
	31	2	5	0
	14	1	1	11
	6	3	6	17
	8	2	1	20

	<i>d.</i>	<i>h.</i>	<i>m.</i>	<i>sec.</i>
(25)	14	21	14	42
	5	17	27	56
	170	10	14	27
	64	17	56	19
	210	23	0	46
	42	4	6	8
	4	19	59	42

A P P L I C A T I O N.

1. **H**OW many Days are there from June 1. to Jan. 27, following?
2. Suppose a Man to be born in the Year of our Lord 1772, in what Year will he be 60 Years of Age?
3. A Gentleman left his eldest Daughter one Thousand Pounds more than the Youngest, whose Fortune was eleven Thousand eleven Hundred and eleven; what was the eldest Daughter's Fortune, and what did the Father leave them?
4. In the Bissextile, or Leap Year, how many Days in each Month, and what is their Sum?
5. A. owes such a Sum of Money, that if he paid seventeen Pounds seventeen Shillings and six Pence, the Remainder to pay will be eighty two Pounds two Shillings and six Pence; required the Sum owed?
6. A Privateer took a Prize, the private Men's Share came to 474*l.* 17*s.* 11½*d.* and the Officers received as much, besides 467*l.* unknown to the private men; how much did the Officers receive?
7. A Nobleman, going out of Town, is informed by his Steward that his Corn-Chandler's Bill comes to 123*l.* 19*s.* His Brewer's to 41*l.* 10*s.* His Butcher's 212*l.* 6*d.* To his Lordship's Baker is owing 24*l.* To his Tallow-Chandler 13*l.* 8*s.* To his Taylor 137*l.* 9*s.* 9*d.* To his Draper 74*l.* 13*s.* 6*d.* His Coachmaker's Demand was 214*l.* 16*s.* 6*d.* His Wine-Merchant, 68*l.* 12*s.* His Confectioner's 16*l.* 2*s.* His Rent 82 Guineas, and his Servant's Wages, for Half a Year, came to 46*l.* 1*s.* What Money must he send to his Banker for, in Case

Case he would carry with him 50*l.* to defray his Expences on the Road?

8. A Corn-factor buys seventy Quarters of Oats, for 46*l.* 7*s.* 6*d.* thirty-eight Quarters of Beans, for 100*l.* twelve Quarters of Pease, which cost 16*l.* 16*s.* eighty-eight Quarters of Barley, for 73*l.* 8*d.* sixteen ditto of Wheat, for 56*l.* 9*s.* 10*d.* and six Quarters of Rye, for 4*l.* 4*s.* 6*d.* The Water Carriage of all comes to 13*s.* 2*s.* 7*d.* his riding Charges to 1*l.* 13*s.* and if he clears eighteen Guineas by the Bargain, what do his Bills of Parcels amount to?
9. A Collector of Cash has been out with Bills, and gives an Account that A. paid him 13*l.* and Half a Crown; B. 2*l.* 13*s.* C. 14*s.* and a Groat. D. 1*l.* 9*s.* 8½*d.* E. 11*l.* 6½*d.* F. 17*s.* and a Tester. G. 12*s.* 6*d.* H. a Pound, and Half a Guinea. I. a Moidore, and 13*s.* K. two broad Pieces of 23*s.* each, a Jacobus of 25*s.* and a Shilling. L. nine Pounds and a Mark. M. 12*l.* 12*s.* N. a Bank Note of 15*l.* and O. three Crown Pieces and an Angel: what Cash had he in Charge?
10. A. of Amsterdam is Debtor to B. of Bristol for Mercery Wares, as per Factor, 418*l.* 2*s.* 6*d.* for forty cwt. of Cheshire Cheese, 52*l.* 18*s.* for English broad-cloath, fifteen Pieces, 317*l.* 12*s.* 10*d.* for 19 Fodder of Lead, 320*l.* for 12 Tons of Bar-iron, 173*l.* 3*d.* for eight Tons of Copper, 1110*l.* 10*s.* 1*d.* for his Acceptance of a Bill drawn, 88*l.* 14*s.* for another paid for honour, 50*l.* ten Dozen of Morocco Skins, 28*l.* 15*s.* 4*d.* paid Convoys, Insurance, and Port Charges, 43*l.* Warehouse Room, Postage, Sledage, Boatage, and incidental Charges, 5*l.* 5*s.* The F. storage of all came to 112*l.* 6*s.* For what Sum must B. draw to clear the Account?
11. In a Gentleman's Service of Plate there are fourteen Dishes, weighing 193 oz. 6 dwts. Plates thirty-six weighing 421 oz. 11 dwts. four Dozen of Spoons, weighing 104 Ounces, 6 dwts. six Salts chased, weighing 32 oz. Knives and Forks, weighing 83 oz. 9 dwts. four Presenters weighing 113 oz. 4 dwts. in Mugs, Tumblers, Beakers, and other odd Pieces, wt. 264 oz. 18 dwts. A Silver Tea-kettle and Lamp, weighing 126 oz. 9 dwts. and the Rest of that Equipage 93 oz. 2 dwts. What Quantity of Plate had the Butler under his Care?

12. A Merchant buys four Bags of Canterbury Hops, No. 1. of which weighed 2 cwt. 2 qr. 10 lb. No. 2. 2 cwt. 1 qr. 16 lb. No. 3. 2 cwt. 24 lb. No. 4. 1 qr. 16 lb. besides a couple of Pockets of ditto, that weighed $58\frac{1}{2}$ lb. each. How many Hundred Weight has he to pay Carriage for, on bringing them to Town?
13. A Gentleman at A. desired to know how far it was to E. and had the following Answer, viz. from hence to B. is 39 m. 6 fur. thence to C. is 46 m. 24 p. then to D. 60 m. 4 fur. 39 p. and thence to E. 37 m. 6 fur. What is the Distance from A. to E?
14. A Father was 28 Years old, (reckoning 13 Months to 1 Year, and 28 Days to one Month) when his eldest Child was born, betwixt the eldest and second were 2 Years, 10 Months, and 16 Days; betwixt the second and third were one Year, eleven Months; betwixt the third and fourth, were 3 Years, 7 Months, 25 Days, when the fourth is 16 Years, 9 Months, 27 Days. How old is the Father?

SUBTRACTION.

EXAMPLES of INTEGERS.

(1) From 476004 take 120706. (2) From 2,6000 take 106019. (3) From 40106 take 27109.

8. COMPOUND SUBTRACTION.

Teacheth to find the Difference between any two Sums of divers Denominations, as Money, Weights, and Measures, &c.

R U L E.

Subtract as in Integers, only when the under Number of any Denomination is greater than that which stands over it; borrow so many of that Denomination as make one of the next Superior, from which take the under Number, and to the Remainder add the upper Number, which Sum set down, remembering to carry or add one to the next higher Denomination, before you subtract.

EXAMPLES of MONEY.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
(1) From	142	17	$11\frac{1}{2}$
Take	121	4	$6\frac{1}{4}$

Remains

	<i>l.</i>	<i>s.</i>	<i>d.</i>
(2)	210	10	$10\frac{1}{4}$
	176	11	$11\frac{1}{2}$

	<i>l.</i>	<i>s.</i>	<i>d.</i>
(3) Borrowed	264	0	0
Paid	176	12	$6\frac{1}{2}$

Rem. unpaid

	<i>l.</i>	<i>s.</i>	<i>d.</i>
(4)	153	14	$6\frac{1}{2}$
	76	0	$0\frac{3}{4}$

	<i>l.</i>	<i>s.</i>	<i>d.</i>
(5) Lent	47	6	$0\frac{1}{2}$
Received	36	16	$0\frac{1}{4}$

Rem. unpaid

	<i>l.</i>	<i>s.</i>	<i>d.</i>
(6)	300	10	11
	196	17	$11\frac{3}{4}$

Borrowed

Subtraction.

	£.	s.	d.
Borrowed	476	0	0
(7) Paid at sundry Times.	41	17	6
	127	10	11
	89	18	4
	94	17	10
	16	12	6

Paid in all

Rem. unp.

Borrowed	214	16	4 $\frac{1}{2}$
	176	11	11 $\frac{1}{4}$
at sundry Times.	647	16	4 $\frac{1}{2}$
	84	12	0 $\frac{1}{2}$
(9)	317	16	10 $\frac{1}{2}$
	176	15	4
	500	0	0
	147	17	6
	374	13	11
	7	19	6

Bor. in all

Paid

Rem. unp.

	£.	s.	d.
Lent	1476	14	6
(8) Rec. at sundry Times.	147	14	11
	376	19	6
	600	17	10
	276	14	6
	47	18	0

Received in all

Rem. unp.

Paid	142	14	6
	176	17	11 $\frac{3}{4}$
at sundry Times.	67	19	6
	476	0	0
(10)	147	10	10
	67	18	8
	100	0	0
	427	18	11 $\frac{1}{4}$
	176	6	4
	42	17	6
	17	10	0

Paid in all

OF WEIGHTS and MEASURES.

	lb.	oz.	dts.	grs.
Bought	14	10	12	17
Sold	11	11	14	21

Rem. unfs.

	oz.	dts.	grs.
(2)	16	10	21
	12	17	14

	lb.	3.	3.	3.	grs.
(3)	17	11	4	0	11
	14	10	6	2	17

	Tons.	C.	grs.	lb.
From	14	11	2	17
Take	12	11	2	24

Remains

	lb.	oz.	dwt.
(5)	140	10	14
	137	14	15

	yds.	grs.	na.
(6)	141	2	3
	74	3	2

Subtraction.

35

(7)
Eng.ells. gr. na.
From 120 4 2
Take 117 4 3

Rem.

(8)
Fl.ells. gr. na.
128 0 0
69 2 3

(9)
Lea. m. fur. pa.
120 1 4 24
80 2 7 37

(10)
Yds. f. in. b.c.
From 148 2 10 2
Take 97 2 11 2

Rem.

(11)
A. r. p.
246 0 0
178 2 24

(12)
Tens. p. bbd. gal. p.
12 1 1 41 7
11 1 0 61 6

(13)
Punch. gal. qts. pts.
Bought 14 64 2 1
Sold 10 72 3 1

Rem. unfs.

(14)
Tier. gal. pts.
16 40 4
12 41 7

(15)
Anch. gal. pts.
24 4 4
17 7 7

(16)
A. bbd. gal. qts.
From 24 41 2
Take 17 47 3

Rem.

(17)
B. bbd. gal. pts.
12 46 4
10 51 7

(18)
B. fir. gal. pts.
14 4 4
10 8 6

(19)
A. ba. fir. gal. qts. pts.
From 42 2 4 2 1
Take 14 3 7 2 1

Rem.

(20)
Qu. bu. p.
12 4 2
6 7 3

(21)
Cha. bu. p.
21 24 0
14 34 2

(22)
La. w. q. b. p.
From 12 1 4 4 2
Take 8 0 4 7 3

Rem.

(23)
Mo. w. d. b.
14 2 4 21
11 2 6 22

(24)
D. b. m. sec.
264 14 24 41
107 21 41 56

A P P L I C A T I O N.

1. Suppose a Person was born in the Year of our Lord seven-
teen Hundred and thirty-five, how old is he this pre-
sent Year being 1784?
2. There are two Numbers, the greater is 102, and the
lesser 72, what is their Difference and Sum?
3. A. and B. having each a Sum of Money, A.'s Sum
which is the greatest, is 74*l.* 17*s.* and the Difference of
their Sums is 4*l.* 13*s.* 6*d.* I demand B.'s Sum?
4. Suppose I borrow 100*l.* and pay in Part 41*l.* 17*s.* 6*d.*
how much remains to pay?
5. Suppose a Gentleman has an Estate, of 600*l.* per Annum,
and he pays Land-Tax 14*l.* also for Repairs 94*l.* 17*s.*
6*d.* what is his neat Estate per Annum?
6. A Person dying left 13111*l.* 10*s.* 6*d.* between his Son and
Daughter; the Daughter was to have eleven Thousand,
eleven Hundred and eleven Pounds, what was the Son's
Fortune?
7. A Horse in his Furniture is worth 35*l.* 10*s.* out of it 12*l.*
12*s.* how much does the Price of the Furniture exceed
that of the Horse?
8. A Trader failing was indebted to A. 71*l.* 12*s.* 6*d.* To
B. 34*l.* 9*s.* 9*d.* To C. 16*l.* 8*s.* 8*d.* To D. 44*l.* To E.
66*l.* 7*s.* 6*d.* To F. 11*l.* 2*s.* 3*d.* To G. 19*l.* 19*s.* And
to H. a Fine of 30 Marks. At the Time of this Disas-
ter he had by him in Cash 3*l.* 13*s.* 6*d.* in Commodities
he had 23*l.* 10*s.* in Household Furnture 13*l.* 8*s.* 6*d.* in
Plate 7*l.* 18*s.* 5*d.* in a Tenement 56*l.* 15*s.* in recover-
able Book Debts 87*l.* 13*s.* 10*d.* Supposing these
Things faithfully surrendered to his Creditors, what
will they then lose by him?
9. A. made a Bond for 114*l.* 10*s.* the Interest came to 19*l.*
He then paid off 40 Guineas, and gave a fresh Bond
for what was behind. By the Time there was 13*l.* 4*s.*
8*d.* due on the second for Interest, he paid off 37*l.* 14*s.*
2*d.* more; took up the old Bond, and signed a new one
still for the Residue, the Principal again run on till
there was 9*l.* 11*s.* 3*d.* more due, and then he determined
to take it up; pray what Money had his Creditor to receive?
10. A Chaise, Horse, and Harness, were altogether valued
at 50*l.* the Horse in Harness was worth 38*l.* 16*s.* 6*d.*
the

the Chaise and Harness were estimated at 13 Guineas; their several Valuations are required?

11. Received in Lieu of two Gold Repeaters, sent to Jamaica in 1782, the five Chests of Indigo following; and on a like Adventure in 1784, the subsequent five Chests: The Question is, how much Indigo I had less the second Time than the first?

Anno 1782.	cwt.	qr.	lb.	lb. A. 1784.	cwt.	qr.	lb.	lb.
No. 1.	2	1	16	Tare 43	1	3	7	Tare 32
2.	2	2	11	47	1	3	17	32
3.	2	0	12	41	1	2	10	30
4.	2	0	19	42	1	0	13	27
5.	2	3	17	49	2	0	11	34

12. A, B, and C, open an Account with a Banker, Jan. 11, 1784, and put into his Hands, viz. A. 17 Guineas, B. 34*l.* 11*s.* 6*d.* C. 23*l.* 18*s.* 10*d.* On the 21st, A, withdrew 9*l.* 10*s.* and C. advanced 12*l.* and a Crown. The 24th. B. called for 6*l.* 10*s.* The 30th, C. wanted 19*l.* 8*s.* 4*d.* on the 12th of Feb. B. deposited with him eleven Carolus's, each 23*s.* and 3 Moidores. On the 19th, A. sent for 5*l.* and a Noble more; but on the 24th returned him 42*l.* On the 2^d of March, C. paid in twenty Guineas, and B. drew for six. The 14th B. sent in 17*l.* 8*s.* 8*d.* and the 17th A. had back 12*l.* 2*s.* 6*d.* On the 19th they sent for five Guineas a Man, and on the 24th they returned that Sum, and ten Marks a-piece more: How much did their said Banker owe them jointly and separately at Lady-Day?

EXAMPLES of INTEGERS.

(1) Multiply	{ 14276084 }	by	{ 4 (5) }	Multiply	{ 147624 }	by	{ 69 }
(2) Multiply	{ 20749509 }		{ 9 (6) }	Multiply	{ 42768 }		{ 748 }
(3) Multiply	{ 1204674 }		{ 12 (7) }	Multiply	{ 10646 }		{ 5278 }
(4) Multiply	{ 4074746 }		{ 16 (8) }	Multiply	{ 14276 }		{ 39674 }
(9) Multiply	{ 3142708 }				{ 467852 }		
(10) Multiply	{ 27680709 }				{ 40700609 }		
(11) Multiply	{ 2142760 }				{ 4100 }		
(12) Multiply	{ 21700 }				{ 954000 }		
(13) Multiply	{ 46904 }				{ 27 }		
(14) Multiply	{ 10709 }				{ 336 }		

C O N T R A C T I O N S.

1. When the Multiplier consists of the same Figures in all the Places, i. e. all 9's or all 7's, &c. then for each Figure in the Multiplier, annex a Cypher to the Multiplicand, and if the repeating Figure is 9, the Remainder will be the Product required; but if any other Figure, multiply it into the 9th Part of the Remainder; or, for the Figure 3, take the 3d Part of the Remainder; and for 6. multiply the 3d Part by 2, which will give the required Number.

E X A M P L E S.

$$\begin{array}{l}
 (1) \\
 (2) \\
 (3) \\
 (4) \\
 (5) \\
 (6)
 \end{array}
 \begin{array}{l}
 \text{Multiply} \\
 \left\{ \begin{array}{l} 47627 \\ 27464 \\ 4674 \\ 47694 \\ 74763 \\ 42763 \end{array} \right\}
 \end{array}
 \text{by}
 \left\{ \begin{array}{l} 9999 \\ 11111 \\ 2222 \\ 7777 \\ 3333 \\ 6666 \end{array} \right.$$

2. In many Cases the Work may be performed with more Ease, likewise more concise than is usually practised.

E X A M P L E S.

$$\begin{array}{l}
 (7) \\
 (8)
 \end{array}
 \begin{array}{l}
 \text{Multiply} \\
 \left\{ \begin{array}{l} 4276 \\ 6946 \end{array} \right\}
 \end{array}
 \text{by}
 \left\{ \begin{array}{l} 126 \\ 486 \end{array} \right.$$

9. COMPOUND MULTIPLICATION

Teacheth to multiply (by one common Multiplier) any Sum or Number consisting of divers Denominations.

1. When the given Quantity doth not exceed 12.

R U L E.

1. Write the Multiplier (or given Quantity) under the lowest Denomination of the Multiplicand.
2. Multiply the Number of the lowest Denomination by the Multiplier, and divide that Product by as many of that, as make one of the next higher Denomination the same which you stopped at in Addition, set down the Remainder underneath its own Place, and add the Quotient to the next superior Denomination, as you multiply;

tiply, in this Manner proceed with all the other Denominations to the highest.

EXAMPLES of MONEY.

	£.	s.	d.		£.	s.	d.		£.	s.	d.
(1) Multiply	14	17	11	(2)	140	10	0 $\frac{1}{2}$	(3)	17	6	4
			2				6				9
Product											

4. 4 Yards of Cloth, at 17s. 6 $\frac{1}{2}$ d. per Yard.
5. 5 Hundred of Cheese, at 3l. 0s. 6d per Cwt.
6. 7 Ells of Holland, at 7s. 10d. per Ell.
7. 8 Pounds of Tea, at 18s. 9 $\frac{1}{2}$ d. per lb.
8. 9 Gallons of Wine at 12s. 8d. per Gall.
9. 10 Anchors of Brandy, at 2l. 6s. 4d. per Anch.
10. 11 Barrels of small Beer, at 12s. 7d. per Barrel.
11. 12 Firkins of Butter at 1l. 17s. 6 $\frac{1}{2}$ d.

2. When the given Quantity exceeds 12, and is such a Number that any two Figures (in the Multiplication Table) being multiplied together will produce it:

R U L E.

Multiply the given Price by one of those Numbers, and the Product by the other, which will give the Answer.

E X A M P L E S.

12. 14 Ounces of Silver, at 6s. 7 $\frac{1}{2}$ d. per oz.
13. 18 lb. of Sagar, as 10 $\frac{1}{4}$ d. per lb.
14. 27 Quarters of Wheat, at 2l. 9s. 6d. per Quar.
15. 30 Yards of German Serge, at 4s. 11 $\frac{1}{2}$ d. per Yard.
16. 36 Stone of Wool, at 10s. 8d. per st.
17. 45 yds. of Tape, at 2 $\frac{1}{2}$ d. per yd.
18. 50 Moidores, at 27s. each.
19. 56 Yards of Shalloon, at 2s. 7 $\frac{1}{2}$ d per Yard.
20. 64 Firkins of Butter at 1l. 11s. per Firkin.
21. 72 Reams of Paper, at 15s. 9d. per Ream.
22. 80 Yards of Yorkshire Camblets, at 11 $\frac{1}{4}$ d. per Yard.
23. 84 Gallons of Oil, at 9s. per Gal.
24. 96 Yards of Indian Dimity, at 1s. 10 $\frac{1}{4}$ d. per Yard.

Multiplication.

- 25. 99 Yards of Broad Cloth, at 18s. 11½d. per Yard.
- 26. 100 Yards of Cambric, at 11s. 10d. per Yard.
- 27. 120 Hundred of the best Dutch Pens, at 1s. 6d. per h.
- 28. 132 Deals, at 1s. 10d. each.
- 29. 144lb. of Tobacco, at 1s. 7½d. per lb.

3. When the given Quantity cannot be produced by the Multiplication of two small Numbers.

R U L E.

Find the nearest Number to its less, by which, multiply as before, then for what is wanting, multiply the Price by that Number, and add to it the last Product, and the Total will be the Answer.

E X A M P L E S.

- 30. 17 Cwt. of Malaga Raisins, at 1l. 4s. 10½d. per Cwt.
- 31. 19lb. of fine Hyson Tea, at 19s. 11¼d. per lb.
- 32. 29 Yards of Diaper, at 1s. 7½d. per yd.
- 33. 38 Dozen of Men's fine common Hose, at 2l. 17s. 6d. per doz.
- 34. 47 Yards of flowered Linen, at 5s. 10d. per yd.
- 35. 58 Ells of Holland, at 10s. 4½d. per Ell.
- 36. 67 Cwt. of Tobacco, at 5l. 17s. per Cwt.
- 37. 75 Dozen of Soap, at 6s. 4½d. per Doz.
- 38. 26 Yards of green Silk Damask, at 19s. 1¾d. per yd.
- 39. 106 of Vyse's Tutor's Guide, at 3s. 6d. each.

4. When the given Quantity consists of $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$.

R U L E.

Divide the upper Line (the Price of one) by 4 for $\frac{1}{4}$, by 2 for $\frac{1}{2}$, and for $\frac{3}{4}$, by 2 first for $\frac{2}{4}$, then divide that Quotient by 2, for $\frac{1}{4}$; add them to the Product, and the Sum will be the Answer required.

E X A M P L E S.

- 40. 35½ Tons of Hay, at 3l. 6d. per Ton.
- 41. 76½ Dozen of Red Port, at 1l. 12s. 10d. per Dozen.

42. $17\frac{1}{2}$ Barrels of Ale, at $36s. 6\frac{1}{2}d.$ per Bar.
 43. $8\frac{1}{2}$ Butts of Beer, at $4l. 6s. 7d.$ per Butt.
 44. $100\frac{1}{2}$ Acres of Land, at $26l. 17s. 6d.$ per Acre.

This Method of finding the Value of any Quantity of Goods under 100, at any Price per yd. lb. &c. is of excellent Use to such as buy or sell by Retail.

But for great Quantities, there are other Methods much better. (See PRACTICE.)

Yet sometimes it may so happen, that your given Quantity, though considerably great, may be wrought by the continual Product of three Numbers, as the following.

E X A M P L E S.

45. 112 Bushels of Oats at $1s. 10\frac{3}{4}d.$ per Bush.
 46. 336 Yards of Dowlas, at $2s. 5d.$ per Yard.
 47. 350 oz. of Cloves, at $11\frac{1}{4}d.$ per oz.

OF WEIGHTS and MEASURES.

(1)	14lb. 10oz. 0dwts. 21grs.		4
(2)	17 Tons, 17 cwt. 0qr. 24lb.		2
(3)	14 cwt. 0qr. 21lb. 0oz. 14drs.		7
(4)	10 lb. 6 3/4. 43. 1 3/4. 17grs.		9
(5)	127 yds. 0qr. 3na.		12
(6)	40 Ells Eng. 4 qrs. 2na.		11
(7)	120lea. 7fur. 24p.		5
(8)	147 yds. 2f. 11in. 2. b. c.		6
(9)	46 W. hhds. 47 gal. 7 pts.	by	3
(10)	6 Tuns, 1 p. 1 hhd. 46 gal. 3 qts.		8
(11)	27 ter. 41 gal. 2 qts.		6
(12)	4 B. hhd. 47 gal. 6 pts.		9
(13)	10 A. hhds. 17 gal. 3 qts. 1 pt.		4
(14)	12 B. bar. 2 fir. 7 gal. 7 pts.		6
(15)	140 A. 2 r. 26 p.		5
(16)	74 Last, 7 qrs. 4 bu. 1 p.		7
(17)	365 D. 5 h. 48 m. 57 sec.		12

A P P L I C A T I O N.

1. What Number taken from the Square of 54, will leave 19 Times 46?
 2. Suppose 50 Men to take a Prize, and each Man's Share comes to 142l. What is the Value of the Prize?

† E 3

3. What

3. What is the Difference, and what the Sum, of six dozen dozen, and half a dozen dozen?
4. A certain Island contains 52 Counties, every County 42 Parishes, every Parish 246 Houses, and every House 10 Persons. I demand the Number of Parishes, Houses, and Persons that are in the whole Island?
5. What Difference is there between twice eight and twenty, and twice twenty-eight: As also, between twice five and fifty, and twice fifty-five?
6. By God's Blessing upon a Merchant's Industry, in ten Year's Time he found himself possessed of 13000*l.* it appeared from his Books, that the last three years he had cleared 873*l.* a Year; the three preceding, but 586*l.* a Year, and before that, but 364*l.* a Year. The Question is, what was the State of his Fortune at every Year's End that he continued in Trade, and what had he to begin with?
7. A Robbery being committed on the Highway, there was assessed on a certain Hundred, in the County of S. the Sum of 373*l.* 14*s.* 8*d.* of which the four Parishes paid 37*l.* 16*s.* 4*d.* the four Hamlets 28*l.* 3*s.* 10*d.* each, the four Townships nineteen Guineas each: What was the Deficiency?
8. At Leicester and several other Places, they weigh their Coals by a Machine, in the Nature of a Steel-Yard, Waggon and all; three of these Draughts together amount to 137 cwt. 2 qrs. 10 lb. and the Tare or Weight of the Waggon was 13 cwt. 1 qr. How many Coals had the Customer to pay for?
9. A Person dying left his Widow 1780*l.* and 125*l.* to each of his four Children, 30 Guineas a-piece to 15 of his poor Relations, and 150*l.* to Charities; he had been 25½ Years in Trade, and at an Average had cleared 126*l.* a Year: What had he to begin with?
10. Suppose a Gentleman's Income is 500*l.* per Annum, and he expends daily 19*s.* 11*d.* What doth he lay up at the Year's End?
11. If a Gentleman expendeth daily 1*l.* 12*s.* 6*d.* and at the Year's End layeth up 294*l.* 12*s.* 6*d.* I demand his yearly Income?
12. The Remainder of a Division Sum is 20, the Quotient 423; the Divisor is the Sum of both and 19 more; what was the Number to be divided?

13. Suppose

13. Suppose that for a Quarter's Rent I pay in Money seven Guineas and six Pence, and was allowed for small Repairs 18s. 6d. for the King's Tax 8s. 5d. What did my Tenement go at a Year?
14. A Person dying left his Widow the Use of 5000*l.* To a Charity he bequeathed 846*l.* 10*s.* To each of his three Nephews 1230*l.* To each of his four Nieces 1050*l.* To 20 poor House-keepers five Guineas each, and 200 Guineas to his Executor: What must he have died possessed of?
15. A Gentleman gave his Daughter to her Portion a Scrutoire, in which was twelve Drawers, in each of these are six Divisions, and in each Division there was 100*l.* a Moidore, and Half a Guinea: What was the young Lady's Fortune?

D I V I S I O N.

EXAMPLES of INTEGERS.

(1)	[14076893]	[4.
(2)	[30742165]	[12.
(3)	[2410296]	[89.
(4)	[98420649]	[576.
(5)	[308763705]	[3029.
(6)	[16221212499]	[46058.
(7)	[51799555]	[127345.
(8)	[78855994985]	[3090807.
(9)	[1276421427]	[3700.
(10)	[4074964478]	[827000.
(11)	[24769851400]	[9300.
(12)	[67402]	[14.
(13)	[701747]	[63.
(14)	[4170642]	[112.
(15)	[2741724]	[336.

C O N T R A C T I O N S.

When the Divisor consists of the same Figure in all the Places, that is, all 9's or all 7's, &c. annex as many Cyphers to Unity or 1, as there are 9's or 7's, &c. in the given Divisor, for a new Divisor; and if the repeating Figure is 9, divide the Dividend by that Divisor, and do the

the same with the Quotient, till you get 0, for an integral Quotient, then add all the Over-plusses together, and divide that Sum by the given Divisor, the Over-plus thence arising is that required, and the Sum of all the integral Quotients is the Quotient required; for any other Figure, divide 9 Times the Dividend so, and the integral Quotient by the repeating Figure: This gives the true integral Quotient; and if the 9th Part of the first Over-plus be added to the Second, repeated as the given Figure, the Sum will be the true Over-plus.

E X A M P L E S.

$$\begin{array}{l} (16) \\ (17) \\ (18) \\ (19) \end{array} \text{Divide } \left\{ \begin{array}{l} 4677823 \\ 2692464 \\ 4769042 \\ 109494 \end{array} \right\} \text{ by } \left\{ \begin{array}{l} 999 \\ 1111 \\ 7777 \\ 6666 \end{array} \right.$$

10. COMPOUND DIVISION.

Teacheth to divide (by one common Divisor) either a simple or compound Number, into any proposed Number of equal Parts, whereof each shall be a compound Number.

1. When the Divisor doth not exceed 12.

R U L E.

1. Place the Divisor and Dividend as Integers.
2. Writing their Quotas under each respective Dividend.
3. But if there be a Remainder after dividing any of the Denominations except the least, you must find how many of the next lower Denomination it is equal to, by multiplying it by as many of the next less as make one of that, which add to the next (if any) and divide as before.

E X A M P L E S of M O N E Y.

$$\begin{array}{r} \text{l.} \quad \text{s.} \quad \text{d.} \\ (1) \quad 2) 14 \quad 16 \quad 10\frac{1}{2} \\ \hline \hline \end{array}$$

$$\begin{array}{r} \text{l.} \quad \text{s.} \quad \text{d.} \\ (2) \quad 7) 267 \quad 0 \quad 0 \\ \hline \hline \end{array}$$

(3)

$$\begin{array}{r} (3) \ 8 \overline{) 171 \ 11 \ 4} \\ \underline{ 160} \\ 11 \\ \underline{ 96} \\ 15 \end{array} \quad \begin{array}{r} (4) \ 9 \overline{) 317 \ 0 \ 6} \\ \underline{ 27} \\ 47 \\ \underline{ 45} \\ 2 \end{array} \quad \begin{array}{r} (5) \ 11 \overline{) 66 \ 11 \frac{1}{2}} \\ \underline{ 55} \\ 11 \\ \underline{ 11} \\ 0 \end{array}$$

6. Bought 3 cwt. of Cheese, for which I gave 7*l.* 11*s.* 6*d.* at what Rate did I give per cwt.?
7. If 10 Dozen of Candles cost 3*l.* 17*s.* 1*d.* what costs one Dozen?
8. Suppose I give my Servant 14 Guineas per Year, what does his Monthly Wages come to?

2. When the Divisor exceeds 12, and is such a Number that if any two Figures (in the Multiplication Table) being multiplied together will produce it.

R U L E.

Divide by component Parts, as in Sect. 5. Case 4.

E X A M P L E S.

9. Divide 45*l.* 12*s.* 8*d.* into 16 equal Parts.
10. Divide 3*l.* 13*s.* equally amongst 24 Persons.
11. What is Cloth per Yard, when 36 Yards cost 64*l.* 19*s.*
12. What is Tobacco per cwt. if 42 cwt. cost 190*l.* 4*s.* 6*d.*
13. Bought 48 Yards of Broad Cloth for 37*l.* 14*s.* 8*d.* I desire to know at what Rate I gave per Yard?
14. Suppose a Man spends 78*l.* 16*s.* 8*d.* in 8 Months Time, what is that per Week?
15. A Prize of 4567*l.* 0*s.* 10*d.* is to be equally divided amongst 55 Persons: What is each Man's Share?
16. What is Tea per cwt. when 63 cwt. cost 264*l.* 12*s.*?
17. If 72 oz. of Silver cost 18 Guineas, what is it per oz.
18. Suppose I have 81 cwt. of Cheese, which cost me 121*l.* 12*s.* 6*d.* At what Rate did I buy per cwt.?
19. Divide 174*l.* 1*s.* 8*d.* equally amongst 120 Sailors.

3. When the Divisor cannot be produced by the Multiplication of two small Numbers. Divide as in Sect. 4. Case 2.

E X A M P L E S.

20. Divide 214*l.* 17*s.* 9½*d.* equally among 17 Persons.
21. Divide 476*l.* amongst 145 People.

The following EXAMPLES *require three* DIVISIONS.

22. I gave 30*l.* 2*s.* for 112 Yards of Cambric, at what Rate did I give per Yard?
23. Divide 100*g* equally amongst 350 Persons.
24. Suppose the Cloathing of 224 Charity Children comes to 610*l.* 8*s.* what is the Expence of each?
25. Divide 1426*l.* equally amongst 640 Persons.

4. If the given Quantity or Divisor consists of $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$.

R U L E.

Multiply the given Quantity by 4, adding to the Product 1 for $\frac{1}{4}$, 2 for $\frac{1}{2}$, 3 for $\frac{3}{4}$; and it will give the Divisor, which divide with as before, and the Quotient multiply by 4, will give the Answer.

E X A M P L E S.

26. Suppose I give for 6 $\frac{1}{4}$ Yards of Cambric, 12*l.* 12*s.* 11*d.* at what Rate did I buy it at per Yard?
27. Suppose a Person in Trade to clear 1061*l.* 8*s.* 9 $\frac{1}{4}$ *d.* equally in 10 $\frac{1}{2}$ Years, what was his yearly Increase of Fortune?
28. Suppose another to clear 450*l.* 12*s.* 11 $\frac{1}{2}$ *d.* equally in 8 $\frac{1}{2}$ Years, what was his yearly Profit?

OF WEIGHTS and MEASURE.

E X A M P L E S.

(1)	[8lb. 1 oz. 15 dwts. 8 grs.	} by {	[2
(2)	24 tuns, 14 cwt. 0 qr. 14 lb.		3
(3)	17 cwt. 2 qrs. 27 lb. 14 oz. 15 drs.		4
(4)	4 lb. 11 $\frac{3}{4}$ 43 2 $\frac{1}{2}$ 12 grs.		5
(5)	214 yds. 3 qrs. 2 na.		9
(6)	120 ells Eng. 4 qrs.		8
(7)	12 lea. 2. m. o. fur. 26 p.		9
(8)	147 yds. 2 f. 11 in. 2 b. c.		10
(9)	24 W. hhds. 57 gal.		11
(10)	10 tuns, 1 p. 1 hhd. 60 gal. 3 qts.		8
(11)	16 tier. 20 gal. 7 pts.		6
(12)	76 A. hhds. 27 gal.		5
(13)	12 B. hhds. 49 gal. 2 qts.		4
(14)	61 B. bar. 2 fir. 6 gal.		3
(15)	140 acres, 2 r. 26 p.		12
(16)	60 lafts, 6 qrs. 7 bu. 2 rks.		7
(17)	[145 days, 23 h. 24 m. 56 sec.		[6

A P P L I C A T I O N.

1. An Army of 10000 Men, having plundered a City, took 220000l. What was each man's Share?
2. A certain Man intending to go a Journey of 336 Miles, and would complete the same in 12 Days; it is required how many Miles he must travel each Day?
3. What Number added to the 43d Part of 4429 will make the Sum 240?
4. What Number deducted from the 26th Part of 2262 will leave the 87th Part of the same?
5. What Number, multiplied by 72084, will produce 5190048 exactly?
6. What Number, divided by 419844, will quote 9494, and leave just a third Part of the Divisor remaining?
7. The Sum of two Numbers is 360, the less is 144; what is their Difference, Product, and larger Quote?
8. The Spectator's Club of fat People, tho' it consisted but of 15 Persons, is said (No. 9). to weigh no less than 3 Tons: How much on an Equality was that per Man?
9. What

9. What Number is that, from which if you deduct the 25th Part of 22525, and to the Remainder add the 16th Part of 9696, the Sum will be 1440?
10. What Number, multiplied by 57, will produce just what 134. multiplied by 71 will do?
11. Subtract 30079, out of fourscore and thirteen Millions, as often as it can be found, and say what the last Remainder exceeds or falls short of 21180?
12. A Gentleman at his Death left his eldest Son, once and a half what he allotted his Daughter, and to the young Lady 1383*l.* less than her Mother; to whom he bequeathed four Times what he left towards the Endowment of Hertford College, Oxon. viz. 1640 Guineas, I require what he intended for his younger Son, who claimed under the Will half as much as his Mother and Sister? How much less than 30000*l.* did the Testator die worth, after his Debts and Funeral Expences, being 988*l.* 10*s.* were paid?
13. My Purse and Money, quoth Dick, are worth 12*s.* 8*d.* but the Money is worth seven Times the Purse: Pray what was there in it?
14. A young Fellow owed his Guardian 74*l.* 18*s.* 2*d.* on Balance. He paid off 41*l.* 14*s.* 8*d.* and then declared his Sister owed the Gentleman half as much again as himself: On hearing this, she pays off in Part 13*l.* 12*s.* 10*d.* and gives out that her Uncle William was not then less in Arrear than her Brother and she together. The Uncle hereupon pays in 24*l.* 7*s.* 3*d.* and then the Uncle's Brother, who, by the bye, was not the Uncle of those Children, for 150*l.* undertakes to set them all clear, and has 35*l.* 15*s.* 5*d.* he says, to spare: Can that be true?
15. A Dealer bought two Lots of Snuff, that together weighed 9 cwt. 3 qrs. 16 lb. for 97*l.* 17*s.* 6*d.* their Difference in point of Weight, was 1 cwt. 2 qrs. 16 lb. and of Price 8*l.* 13*s.* 3*d.* Their respective Weights and Values are required?
16. A Father left among seven Sons and a Daughter, an Estate consisting of 10000*l.* in Cash, with 8 Bills, each 54*l.* 10*s.* 6*d.* He ordered 36*l.* to be bestowed upon his Burial, and his Debts to be paid, amounting to 260*l.* then his free Estate to be divided in this Manner, viz. the Daughter to have the 9th Part, and the seven Sons

to have equal Shares: What is the Daughter's Part, and also what is the Share of each Son?

R E D U C T I O N.

In this and all the following Rules, all great Names are brought into small by Multiplication, on the contrary, all small Names into great by Division (6).

E X A M P L E S of M O N E Y.

1. In 130*l.* how many Shillings, Pence, and Farthings?
2. How many Pence, Shillings, and Pounds, are in 24000 Farthings?
3. In 80*l.* 15*s.* 11½*d.* how many Farthings?
4. Reduce 16921 Farthings to Pounds.
5. Reduce 110*l.* 0*s.* 6½*d.* to Half Pence.
6. How many Pounds, &c. are there in 20553 Half-Pence?
7. In 107*l.* 10*s.* 8*d.* how many Two-Pences?
8. Reduce 5348 Two-Pences to Pounds.
9. Reduce 6*l.* 17*s.* to Three-Pences.
10. In 2782 Three-Pences, how many Pounds, &c.?
11. In 10*l.* 10*s.* 8*d.* how many Four-Pences?
12. Reduce 3859 Four-Pences to Pounds.
13. How many Six-Pences are there in 200*l.* 17*s.*?
14. Reduce 795 Six-Pences to Pounds, &c.
15. In 21 Guineas, how many Shillings, Pence, and Farthings?
16. How many Guineas in 24192 Farthings?
17. In 12 Moidores how many Farthings?
18. How many Moidores are there in 3240 Pence?
19. In 30*l.* how many Crowns, Half-Crowns and Pence?
20. Reduce 20160 Pence to Half-Crowns, Crowns, and *£*.
21. In 25 Crowns how many Shillings, Groats, and Pence?
22. Reduce 25200 Pence to Groats, Shillings, and Crowns.
23. In 25*l.* how many Shillings, Crowns, and Pence?
24. How many Shillings and Pounds in 80 Crowns?
25. How many Crowns, Half-Crowns, and Shillings, are in 213*l.* 15*s.* 6*d.* and of each an equal Number?
26. In 120*l.* how many Half-Crowns, Crowns, Groats, and Shillings?
27. In 36 Crowns, as many Half-Growns, Shillings, and Groats, how many Pounds?

† F

28. Reduce

28. Reduce 470*l.* 17*s.* to Shillings and Moidores?
 29. Reduce 240 Guineas, to Shillings, Crowns, and Pounds.
 30. In 21 Purfes, each Purfe with 21 Guineas, a Crown, and a Moidore in, what Sterling do they contain?

C O I N S.

1. To Reduce Foreign and English Coin to Pounds Sterling.

R U L E.

Multiply the given Number of Pieces, by the Shillings, Six-Pences, Four-Pences, Three-Pences, Two-Pences, Pence, or Half-Pence, &c. that are in one Piece, and the Product will be according, which bring into Pounds Sterling.

E X A M P L E S.

31. How many Pounds Sterling are there in 1178 Dollars, at 4*s.* 3*d.* each?
 32. In 470 Pistoles, each 17*s.* 6*d.* how many Pounds Sterling?

2. To Reduce Pounds Sterling into Foreign and English Coin, &c.

R U L E II.

Reduce the given Pound Sterling, and the given Coin, into one Name, that is, if you can reduce them both into Shillings, Six-Pences, Four-Pences, or Three-Pences, &c. do so; then divide one by the other, and the Quotient will be the Answer.

E X A M P L E S.

33. A Merchant is to pay 249*l.* 7*s.* 6*d.* With how many Quarter Guineas can he do it?
 34. In 387*l.* 18*s.* 4*d.* how many Florins at 3*s.* 2*d.* each?

3. To

3. To reduce one Kind of Coin into another Kind of Coin.

R U L E.

To reduce both Coins into the same Denomination, and then divide one by the other.

E X A M P L E S.

35. How many Crowns of 5*s.* 4*d.* each, are in 474 Pistoles of 18*s.* 6*d.* each?
 36. How many Guineas are equal in Value to 1240 Moindores?

OF WEIGHTS and MEASURES.

1. In 14 lb. of Silver, how many Ounces, Penny-weights, and Grains?
2. How many lb. of Silver are there in 138240 grs.?
3. In 19 lb. 10 oz. 17 dwts. 22 grs. how many Grains?
4. Reduce 74342 grs. to Pounds.
5. In 4 Ingots of Silver, each weighing 4 lb. 6 oz. 22 grs. how many Grains?
6. How many Ingots of 6 lb. 11 oz. 14 dwts. each, are there in 241056 grs.?
7. How many lb. of Silver, are there in one Dozen of Dishes, each weighing 25 oz. 15 dwts. and one Dozen of Plates, each weighing 15 oz. 15 dwts. 22 grs.?
8. A Gentleman sent 455 oz. 1 dwt. 16 grs. of old Plate, to his Silversmith, with Orders to make it into the following Articles, viz. Punch Bowls each 24 oz. 4 dwts. Tankards each 11 oz. 14 dwts. Tea-pots each 10 oz. 10 dwts. Lamps each 20 oz. 17 dwts. 21 grs. Plates 127 oz. 11 dwts. per Dozen. Spoons of 36 oz. 17 dwts. 23 grs. per Dozen. How many of each must he make supposing for every Dozen of Plates and Spoons he is to make one of each of the other?
9. In 4 $\text{lb. } 10\text{z. } 43\text{. } 19\text{. } 12\text{ grs.}$ how many grs.?
10. Reduce 59934 gr. to z. and lb.
11. In 6 Tons, how many cwt. qrs. and lb
12. How many Tons in 26880 lb.?
13. Reduce 74 cwt. 2 qrs. 16 lb. 7 dr. to Drams.
14. In 29768 oz. how many Hundred Weight?

† F 2

15. Reduce

15. Reduce 67 lb. 12 oz. 15 drs. to Drams.
16. In 6 hhds. of Tobacco, each weighing net 6 cwt. 3 qrs. 27 lb. how many Pounds?
17. How many hhds. of Sugar, each weighing $11\frac{1}{2}$ cwt. are there in 12880 lb.?
18. In 507 cwt. of Lead how many Fother?
19. Out of 12 cwt. 3 qrs. 12 lb. of Tea, how many Canisters can I fill, each Canister holding 12 lb.
20. How many Parcels, each $126\frac{1}{2}$ lb. can I have out of one hhd. of Sugar weighing net $8\frac{1}{2}$ cwt.
21. How many Parcels of 6 lb. 8 lb. 12 lb. and 16 lb. can a Grocer have out of two hhds. of Tobacco, each weighing net 4 cwt. 3 qrs. 24 lb. and to have of each a like Number?
22. Reduce 24 great Pounds, at 24 oz. each, to common Pounds, at 16.
23. In 120 common Pounds how many great Pounds?
24. In 27 yds. 3 qrs. of Cloth, how many Nails?
25. How many Yards in 352 Nails?
26. Reduce 30 Eng. Ells, 4 qrs. 3 na. to Nails.
27. In 569 Nails how many Fl. Ells?
28. In 14 Pieces of Cloth, each 24 yds. how many Nails?
29. Reduce 24768 Nails to Pieces, each 12 Yards.
30. In 12 Pieces of Cloth, each containing 20 Flem. Ells, how many Ells English?
31. How many Pieces of Cloth, each 24 Ells Flemish, are there in 227 Yards?
32. In 4 Bales of Cloth, each 12 Pieces, and each Piece 24 Ells Fl. how many Ells English?
33. In 60 Miles how many Furlongs and Poles?
34. Reduce 12800 Poles to Miles.
35. In 16 Miles, how many Feet, Inches, and Barley-Corns?
36. Reduce 2280060 Barley Corns to Miles.
37. How many Barley-Corns will reach from London to Newcastle upon Tyne, being 276 Miles?
38. How many Times doth the Wheel which is $18\frac{1}{2}$ Feet in Circumference, turn between London and York, being 197 Miles?
39. How many Barley-Corns will reach round the Terrestrial Globe, which is 360 Degrees, and each Degree $69\frac{1}{2}$ Miles?
40. In 64 Acres of Land how many Roods and Poles?

41. Reduce

41. Reduce 21760 Poles to Acres.
42. A common Field, containing 774 Acres, is to be divided into Shares of 270 Perches each, how many Shares doth the Whole contain?
43. A Person rents a Farm, which contains 200 Acres of Land, but he is to till no more than $96\frac{1}{2}$ Acres, I desire to know how many Perches there are in the Remainder?
44. In 12 Tierces of Wine, how many Gallons and Pints?
45. How many Tierces in 6048 Pints?
46. In 4 hhd. 42 gal. 2 qts. of Wine how many Quarts?
47. How many hhd. of Wine in 5746 Pints?
48. A Gentleman ordered his Butler to bottle off a Pipe of red Port into Quart Bottles, how many Dozen will the said Pipe fill?
49. In a Tun of Oil how many Quarts, Pints, and Half-Pints, and of each an equal Number?
50. How many Pipes, Puncheons, Hogheads, and Tierces, and of each a like Number, are there in 1890 Gallons?
51. In 12 Barrels of Ale, how many Gallons and Pints?
52. How many Barrels of Ale in 1704 Pints?
53. In 6 bar. 2 fir. 7 gal. of Beer, how many Gallons?
54. In 10 hhd. 42 gal. 4 pts. of Ale, how many Pints?
55. In 2017 qts. of Ale, how many hhd.?
56. In 12 hhd. of Beer, how many Barrels?
57. In 18 Barrels of Ale, how many hhd.?
58. In 4 tuns, 1 b. 1 hhd. 49 gal. of Beer how many hhd. bar. and fir. and of each a like Number?
59. Reduce 24 qrs. of Wheat to Bushels, Pecks, and Gallons?
60. In 3360 Gallons of Corn how many Quarters?
61. How many Quarters and Bushels are there in 42 la. 4 qrs. 7 bu. of Wheat?
62. In 40 Chaldron of Coals, how many Bush. and Pecks?
63. How many Chaldron of Coals are there in 4762 Bush.?
64. In 47 cha. 30 bush. of Coals, how many Sacks, each 3 Bushels?
65. How many Chaldron of Coals are there in 6450 Sacks, each 3 Bushels?
66. How many Minutes are there in a Julian Year?
67. Reduce 2073600 Seconds to Days.

68. In a Lunar Month, or 27 d. 7 h. 43 m. 5 sec. how many Seconds?
69. How many Thirds are there in a Solar Year?
70. In 31557600 Seconds how many Days?
71. How many Days is it since the Birth of our Saviour, to Christmas, 1784, (allowing Julian Years)?
72. Suppose London was built in 1108 Years before the Birth of our Saviour; how many Days is it since to Christmas, 1784, (allowing the Year as before)?

12. The RULE of THREE DIRECT

Teacheth by three Numbers given to find a fourth in such Proportion to the Third as the Second is to the First, for which Reason it is termed the RULE of PROPORTION, as it is called the RULE of THREE, from its having three Numbers given; and because of its excellent and extensive Use in Arithmetic, it is often named the GOLDEN RULE.

To perform which observe the following

R U L E.

1. State or place the Numbers in such Order, that the first and third Terms be of the same Kind; and the second of the same with the Number required.
2. If your first and third Terms consist of divers Denominations, reduce them into one, and the Second into the lowest Name mentioned.
3. Multiply the second and third Terms together, and divide that Product by the First, the Quotient will be the Answer to the Question in the same Denomination or Name you left your second Term in.
4. If there happens to be a Remainder after the Division, reduce it into the next Denomination below the last Quotient, and divide by the same Divisor, the Quotient will be so many of the said next Name; proceed in this Manner to the least Name, and all the Quotients together will be the Answer.

EXAMPLES.

E X A M P L E S.

1. If 3 Yards of Cloth cost 18*s.* what will be the Value of 17 Yards, at the same Rate?
2. If 2 lb. of Sugar cost 1*s.* 6½*d.* what will 24 lb. of the same cost?
3. If 4 lb. of Candles cost 2*s.* 6*d.* what will 6 Dozen cost at the same Rate?
If 1 cwt. of Cheese cost 26*s.* what will 40 cwt. of the same come to?
Suppose I give 7½*d.* for 1 oz. of Coffee, what must I pay for 1 cwt.?
6. Bought 36 oz. of Silver at the Rate of 5*s.* 4*d.* per Ounce, what does the whole come to?
7. If I buy 12 Pieces of Cloth, and each Piece contains 30 Yards, at 17*s.* 6*d.* per Yard; what is the Value of the Whole?
8. Bought 1 cwt. of Tea, for which I was to give at the Rate of 7*s.* 9*d.* per lb. what doth the Whole stand me in?
9. A Grocer bought 2 cwt. 1 qr. 14 lb. Weight of Cloves, which cost him 34*l.* 6*s.* and he would gain 6*l.* by the Bargain, at what Rate must he sell them at per lb.?
10. Suppose I have by me 200 Yards of Cambric, which cost me 90*l.* but some Damage having happened to it, I am willing to lose 7*l.* 10*s.* by the Whole; at what Rate then I must sell it per Ell English?
11. If 9 Dozen Pound of Candles cost 2*l.* 5*s.* what will 4 lb. of the same cost?
12. A Grocer bought 4 hhds. of Sugar, each weighing net 12 cwt. 2 qrs. 24 lb. and gave after the Rate of 6½*d.* per lb. I demand what the 4 hhds. came to?
13. A Merchant at London buys 46 Tuns of Port Wine, which cost him 579*l.* 12*s.* the Freight thereof from Port to London cost 46*l.* the Loading and Unloading 6*l.* Custom 10*l.* the Charge of the Cellar 4*l.* and he would gain 360*l.* by the Bargain.
A Gentleman comes to him and demands the Price of 26 Tuns of the said Wine: Quere, what he must give?
14. A Factor bought of a Farmer 12 cwt. 2 qrs. 14 lb. of Cheese, and was to give 32*s.* 6*d.* per cwt. what must the Farmer receive for his Cheese?

15. If 1 cwt. of Tea cost 89*l.* 16*s.* 4*d.* at what Rate must it be sold per lb. to lose by the Whole 1*z*l.
16. If in four Months I spend as much as I gain in three, how much do I lay by at the Year's End, if I gain every 6 Months 185*l.* 5*s.* 6*d.*
17. How many Dozen Pair of Gloves, at 16*d.* per Pair, will pay for 36 Dozen and 8 Pair of Stockings, at 4*s.* 6*d.* per Pair?
18. Bought a Parcel of Cloth at the Rate of 6*s.* 6*d.* for every two Yards, of which I sold a certain Quantity at the Rate of 18*s.* 9*d.* for every 5 Yards, and gained thereby as much as 180 Yards cost, now I demand how many Yards I sold?
19. How many Pieces of Holland, each 20 Ells Flem. may I have for 23*l.* 8*s.* at 6*s.* 6*d.* per Ell English?
20. How many Ingots of Silver, each 4 lb. 1 oz. 14 dwts. can I buy for 102*l.* 16*s.* 6*d.* supposing I gave at the Rate of 5*s.* 10*d.* per Ounce?
21. Suppose I give at the Rate of 8*½d.* per oz. for Coffee, how many Parcels, each 1 cwt. can I have for 426*l.* 16*s.*
22. A Gentleman having an Estate of 488*l.* 5*s.* per Ann. he is desirous to know how much he may spend daily, so that he may lay up 100 Guineas at the Year's End?
23. Suppose a Gentleman has an Estate of 564*l.* 12*s.* per Ann. and he is rated at 3*s.* 9*d.* per Pound for the Land-Tax. Quere, his net yearly Income?
24. Suppose I give 5*s.* 9*d.* for 1 oz. of Silver, how many Ingots, each weighing 2 lb. 10 oz. 12 dwts. may I have for 200*l.*
25. A Draper bought of a Merchant 6 Packs of Cloth, every Pack had 6 Parces, and each Parcel contained 10 Pieces, every Piece was 30 Yards; he gave after the rate of 2*l.* 4*s.* 3*d.* for 3 Yards: I desire to know what the 6 Packs cost him per Yard?
26. If 16 Weeks Pay comes to 14*l.* 16*s.* what is that per Year?
27. A Butcher goes with 116*l.* 14*s.* to Smithfield Market, and buys Cattle at the following Prices, viz. Oxen at 10*l.* each, Cows at 7*l.* each, Calves at 1*l.* 10*s.* each, Sheep at 19*s.* each, and of each the same Number; how

- how many of each Sort will the said 116*l.* 14*s.* buy?
28. A Person failing in Trade owed me 56*l.* for which I received only 37*l.* 10*s.* 6½*d.* at what Rate did I receive per Pound?
29. The net Proceeds of a hhd. of Barbadoes Sugar, wt. 18 cwt. 3 qrs. 17 lb. 7 oz. was 4*l.* 14*s.* 6*d.* the Custom and Fees 2*l.* 8*s.* 6*d.* Freight 1*l.* 2*s.* 8*d.* Factorage 4*s.* 6*d.* Pray how must I sell it at per cwt. so that I may gain 5*l.* 10*s.* by the Whole?
30. A certain Tower projected upon level Ground a Shadow, to the Distance of 63 Yards 1 Foot, when a Staff, 3 Feet in Length, perpendicular erected, cast a Shadow of 6 Feet 4 Inches, from hence the height of the Tower is required?
31. Suppose a Person travels 285 Miles in 6 Days, 4 Hours, at what Rate is that per Hour, (allowing 12 Hours to the Day)?
32. Suppose I give 44*l.* 2*s.* for one Pipe of Wine, at what Rate did I give per Pint?
33. The Globe of the Earth, under the equinoctial Line, is 360 Degrees in Circumference; and this Body being turned on its own Axis, in the sydereal Day or 23 Hours, 56 Minutes, at what rate an Hour are the Inhabitants of Bencoolen, (situated in the Midst of the Torrid Zone) carried from West to East by this Rotation?
34. What is the Value of one Grain of Gold, when one Ounce cost 5 Guineas?
35. If 12 Apples are worth 21 Pears, and 3 Pears cost a Half-penny, what will be the Price of fourscore and four Apples?
36. It is a Rule in some Parishes to assess the Inhabitants in Proportion to Eight-tenths of their Rents: What is the yearly Rent of that House, which pays 8*l.* 10*s.* to the King under this Limitation, at 4*s.* in the Pound?
37. If 19 Yards of Yard-wide Stuff exactly line 14 Yards of Silk of another Breadth, how many Yards of the latter will line 184 Pieces of the former, each Piece holding 28½ Yards?
38. In 117 Times 406 Pieces of Coin, worth 3*s.* 8*d.* a piece, how many Reas at 20 for 3*d.* English?

39. A Merchant bought 274 Ells Flemish, of Holland, for 4s. per Ell, and sold it again for 7s. 10d. per Ell English, what did he gain by the Whole?
40. A May Pole 50 Feet 11 Inches long, when the Sun is on the Meridian, will cast a Shadow 98 Feet 6 Inches long; I would thereby find the Breadth of a River, that running due E. and W. within 20 Feet 6 Inches on the North Side of the Foot of a Steeple, 300 Feet 8 Inches high, which at the same Time throws the Extremity of its Shadow 30 Feet 9 Inches beyond the Stream?
41. If two Men in three Days will earn 15s. how much will seven Men earn in the same Time?
42. How far will one be able to travel in 9 Days, 8 Hours, at the Rate of 12 Miles every 4 Hours, allowing 12 Hours to a travelling Day?
43. What will 1000 Yards of Walling amount to, at the Rate of 4s. 6d. per Rod?
44. A Factor bought 64 Pieces of Holland, which cost him 352l. at 5s. 6d. per Ell Flemish; I demand how many Yards there were in all, and how many Ells English in each Piece?
45. If 100l. in 12 Months gain 4l. 15s. what will 40l. 10s. gain in the same Time, the Interest being at the same Rate?
46. If 12 Yards of Yard-wide Stuff exactly line 8 Yards of Silk of another Breadth; how many Yards of the latter will line 24 Pieces of the former, each Piece containing 20 Yards?
47. What is the Quarter's Rent of 240 Acres of Land, at 1l. 19s. 6d. per Acre per Annum?
48. A Person owes 1000l. but not being able to pay the Whole, compounds with his Creditors for to pay them Half a Guinea in the Pound; how much Money doth he pay his Creditors?
49. When the Sun is in the Meridian at Soho-Square, in what Time will it be so at Tyburn, lying due West of it at the Distance of a measured Mile, in the Latitude of $51\frac{1}{2}$ Degrees North, where a Degree of Longitude measures 37 Miles, 2 Furlongs, 37 Poles, 5 Feet, and 6 Inches, known by the diurnal Rotation of the Earth to pass in 4 Minutes Time?

50. How

50. How many Pieces of Holland, each 33 Ells Flem. 1 qr. 2 na. can I have for 118*l.* 17*s.* 7½*d.* when 4 Ells English cost 1*l.* 7*s.* 10*d.*

13. RECIPROCAL PROPORTION;

OR,

The RULE of THREE INVERSE.

Reciprocal Proportion is, when of four Numbers, the Third beareth the same Ratio to the First as the Second doth to the Fourth; therefore the less the Third Term is in respect to the First, the greater will the fourth time be in respect to the Second.

R U L E.

Multiply the First and Second Terms together and divide their Product by the Third Term, the Quotient will be the Answer.

E X A M P L E S.

1. If 48 Men can perform a Piece of Work in 12 Days, how many Men can do the same in 72 Days?
2. How much in Length, that is four Inches broad, will make a Foot square?
3. Suppose I lend my Friend 500*l.* for six Months (allowing the Month to be 30 Days), afterwards he would requite my Kindness by lending me 220*l.* required the Time I must have it, to requite my former Kindness?
4. A Garrison being besieged, has three Months Provisions in it, at the Rate of 14 Ounces per Day each Man; but being informed that it cannot be relieved till the End of 8 Months: How many Ounces per Day must each Man have, that the said Provision may last that Time?
5. If, when the Price of a Bushel of Wheat is 4*s.* 6*d.* the Penny Loaf weighs 12 oz. what must the Penny Loaf weigh when the said Bushel is worth but 3*s.*?
6. Suppose

6. Suppose 275 Yards of Cloth, which is 5 qrs. wide, make Coats for 130 Men; how many Yards of Shalloon, of 3 qrs. wide, will line the said Coats?
7. In what Time will 600*l.* gain 50*l.* Interest, when 80*l.* does it in 15 Years?
8. Suppose 200*l.* would defray the Expences of 10 Men for 43 Weeks and 5 Days; how long would 6 Men be in spending the same Sum?
9. How many Yards of Paper, that is 3 qrs. wide, will hang a Room that is 30 Feet long and 24 Feet wide?
10. A Garrison consisting of 1500 Men, being besieged, have Provisions only for 3 Months, but it being necessary they should hold out 5 Months, how many Men must depart, that the said Provisions may serve that Time?
11. There is a Vessel, having a Cock, which will empty it in 6 Hours: I demand how many Cocks of the same Capacity there must be to empty the said Vessel in 15 Minutes?

14. COMPOUND PROPORTION;

O R,

The R U L E of F I V E,

Is so called, from its having five Numbers or Terms given to find a Sixth, which if the Proportion is direct, the sixth Term must bear such a Proportion to the Fourth and Fifth as the Third bears to the First and Second. But if the Proportion is Inverse, then the sixth Term must bear such Proportion to the Fourth and Fifth, as the First bears to the Second and Third, or as the Second bears to the First and Third.

The Three first Terms are a Supposition, the Two last a Demand.

R U L E.

1. Let the principle Cause of Gain, Loss, or Action, &c. be put in the first Place.
2. Let that which denotes Time, Distance of Place, &c. be in

in the second Place, and the remaining one in the third Place.

3. Place the other two Terms which move the Question underneath those of the same Name.
4. If the Blank or Term sought fall under the third Term, multiply the two first Terms together for a Divisor, and the three last for a Dividend, the Quotient arising from them, will be the Answer or sixth Term.
5. If the Blank fall under the first or second Term, multiply the third and fourth Terms together for a Divisor, and the other three for a Dividend, the Quotient arising from them will be the Answer.

P R O O F.

By two Statings

E X A M P L E S.

1. If 6 Men can mow 72 Acres of Grass in 12 Days, how many Men can mow 120 Acres in 4 Days?
2. Suppose 2 Bushels of Wheat will be sufficient for a Family of 6 Persons 12 Days; how many Bushels will serve 36 Persons 4 Days?
3. Suppose the Salary of 6 Persons for 21 Weeks is 120*l.* what will be the Salary of 14 Persons for 46 Weeks?
4. If for the Carriage of 40 cwt. 100 Miles, I give 9*l.* 5*s.* what Weight can I have carried 125 Miles for 70*l.* 10*s.* 3*½d.* at the same Rate?
5. An Usurer put out 120*l.* to receive Interest for the same; but when it had continued 9 Months, he took it up, and received for the Principal and Interest 125*l.* 8*s.* I demand at what Rate per Cent. per Annum he received?
6. What is the Interest of 259*l.* 13*s.* 5*d.* for 20 Weeks, at 5*l.* per Cent. per Annum?
7. If a Quantity of Provisions serve 1400 Men 20 Weeks, at the Rate of 14 Ounces per Day each Man; how many Men will the same Provisions maintain for 8 Months, at the Rate of 8 Ounces per Day each?
8. Suppose 8 Men earn 5*l.* in 5 Days; how many Men will earn 10 Guineas in 12 Days?
9. Suppose 14*l.* would defray the Expences of five Men

- for twenty four Weeks and four Days; how long would twelve Men be in spending 200*l.* at the same Rate?
10. What Money at $3\frac{1}{2}\%$ per Cent. per Annum, will clear 38*l.* 10*s.* in a Year and Quarter's Time?
11. If a Sack of Coals be the Allowance of 7 poor People for a Week, how many Poor belonged to that Parish, which, when Coals were 36*s.* per Chaldron, had 41*l.* to pay in 6 Weeks on that Account?

15. P R A C T I C E.

So called from the general Use it is to all Persons concerned in Trade and Business.

All Questions in the Rule of Three, where the first Term is Unity or one, may be performed by this Rule.

Which is by taking aliquot or even Parts, by which Means many tedious Reductions may be avoided.

But as there are a great Variety of such Parts, so many, therefore, are the Ways of applying them, that it would be an endless Task to give all the easy Methods of Operation adapted to particular Cases; so I shall only give the General Rules, with a sufficient Number of Examples to each.

In order to perform this Rule expeditiously, it will be necessary that the Learner gets by Heart the following

T A B L E S.

Of a Pound s. d.	Of a Sh. d.	Of a Ton. cwt.	Of an Hund. qr. lb.	Of a Quar. of an C. lb.
1 8 = $\frac{1}{2}$	1 = $\frac{1}{20}$	2 = $\frac{1}{10}$	1 or 28 = $\frac{1}{4}$	3 $\frac{1}{2}$ = $\frac{1}{8}$
2 0 = $\frac{1}{10}$	1 $\frac{1}{2}$ = $\frac{1}{8}$	2 $\frac{1}{2}$ = $\frac{1}{8}$	2 or 56 = $\frac{1}{2}$	4 = $\frac{1}{4}$
2 6 = $\frac{1}{8}$	2 = $\frac{1}{10}$	4 = $\frac{1}{5}$	0 16 = $\frac{1}{7}$	7 = $\frac{1}{7}$
3 4 = $\frac{1}{6}$	3 = $\frac{1}{10}$	5 = $\frac{1}{4}$	0 14 = $\frac{1}{8}$	14 = $\frac{1}{2}$
4 0 = $\frac{1}{5}$	4 = $\frac{1}{10}$	10 = $\frac{1}{2}$		
5 0 = $\frac{1}{4}$	5 = $\frac{1}{10}$			
6 8 = $\frac{1}{3}$				
10 0 = $\frac{1}{2}$				

1. When the Price is less than a Penny.

R U L E.

R U L E.

Divide by the aliquot Parts that are in a Penny, then by 12 and 20, which will give the Answer.

E X A M P L E S.

1. 2107 at $\frac{1}{4}d.$ 2. 1470 at $\frac{1}{2}d.$ 3. 1276 yds. at $\frac{3}{4}d.$ per yd.

2. When the Price is less than a Shilling.

R U L E.

Take the Aliquot Part or Parts that are in a Shilling, add them together, and the Sum will be the Answer in Shillings, &c. which, divided by 20 as before, will give £ &c.

E X A M P L E S.

4. 1762 at $1d.$ 5. 1400 at $1\frac{1}{4}d.$ 6. 2452 at $1\frac{1}{2}d.$ per lb.
 7. 1041 at $1\frac{3}{4}d.$ 8. 290 at $2d.$ 9. 2408 at $2\frac{1}{4}d.$
 10. 640 at $2\frac{1}{2}d.$ 11. 1740 at $2\frac{3}{4}d.$ 12. 746 at $3d.$
 13. 1417 at $3\frac{1}{4}d.$ 14. 3091 at $3\frac{1}{2}d.$ 15. 214 at $3\frac{3}{4}d.$
 16. 2000 at $4d.$ 17. 569 at $4\frac{1}{4}d.$ 18. 1246 at $4\frac{1}{2}d.$
 19. 1426 at $4\frac{3}{4}d.$ 20. 2740 at $5d.$ 21. 2147 at $5\frac{1}{4}d.$
 22. 674 at $5\frac{1}{2}d.$ 23. 1746 at $5\frac{3}{4}d.$ 24. 1741 at $6d.$
 25. 2142 at $6\frac{1}{4}d.$ 26. 1040 at $6\frac{1}{2}d.$ 27. 1746 at $6\frac{3}{4}d.$
 28. 1000 at $7d.$ 29. 1656 at $7\frac{1}{4}d.$ 30. 1420 at $7\frac{1}{2}d.$
 31. 674 at $7\frac{3}{4}d.$ 32. 2170 at $8d.$ 33. 1700 at $8\frac{1}{4}d.$
 34. 1765 at $8\frac{1}{2}d.$ 35. 749 at $8\frac{3}{4}d.$ 36. 1417 at $9d.$

37. 2373 at $9\frac{1}{4}d.$ 38. 1476 at $9\frac{1}{2}d.$ 39. 1760 at $9\frac{3}{4}d.$
 40. 6000 at $10d.$ 41. 4652 at $10\frac{1}{4}d.$ 42. 2476 at $10\frac{1}{2}d.$
 43. 2176 at $10\frac{3}{4}d.$ 44. 1276 at $11d.$ 45. 2142 at $11\frac{1}{4}d.$
 46. 4760 at $11\frac{1}{2}d.$ 47. 640 at $11\frac{3}{4}d.$

3. When the Price is more than a Shilling, but less than two.

R U L E.

Take the Part or Parts, with so much of the given Price, as is more than a Shilling, (as in the last Rule,) which add to the given Quantity, and the Sum will be the Answer in Shillings, &c. which divided by 20, will give £.

Note. The Method of performing this Case, being so little different from the last, I shall only give a few Examples, which by proper Instructions from the Tutor will suffice.

E X A M P L E S.

48. 1074lb. at $1s\ 10\frac{1}{4}d.$ 49. 2140 at $1s\ \frac{1}{4}d.$ per Ounce.
 50. 1749 at $1s\ 11\frac{1}{4}d.$ 51. 2140 at $1s\ 5d.$
 52. 1453 at $1s\ 7\frac{1}{2}d.$ 53. 1614 at $1s\ 10d.$
 54. 2647 at $1s\ 11\frac{1}{4}d.$

4. When the Price consists of any even Number of Shillings, under 20.

R U L E.

Multiply the given Quantity by Half the Price, doubling the First Figure of the Product for Shillings, and the Rest of the Product will be £.

E X A M P L E S.

E X A M P L E S.

55. 2476 at 2s. 56. 1476 at 4s. 57. 276lb. at 6s. per lb.
 58. 2100 at 8s. 59. 274 at 10s. 60. 674 at 12s.
 61. 2680 at 14s. 62. 267 at 16s. 63. 1267 at 18s.

5. When the Price is any odd Number of Shillings under 20.

R U L E.

Multiply the given Quantity by the Price, and the Product will be the Answer in Shillings, which divided by 20 will give £.

E X A M P L E S.

64. 2174 at 7s. 65. 1427 at 9s. 66. 647 at 11s.
 67. 267 at 13s. 68. 274 at 17s. 69. 1260 at 19s.

6. When the Price is Shillings, or Shillings and Pence, and they an aliquot Part of a Pound.

R U L E.

Divide by the aliquot Part, and the Quotient will be the Answer.

E X A M P L E S.

70. 2420 at 4s. 71. 1764 at 5s. 72. 4762 at 1s. 8d. per yd.
 73. 467 at 2s. 6d. 74. 1760 at 3s. 4d. 75. 176 at 6s. 8d.

7. When the Price is Shillings, Pence, and the Shillings and Pence be not an aliquot Part of a Pound.

R U L E.

Multiply the given Quantity by the Shillings, and take Parts for the Pence, &c. add them together, and the Sum will be the Answer in Shillings, which, divided by 20, will give £.

E X A M P L E S.

- | | |
|-----------------------------|-------------------------------------|
| 76. <u>1420 at 3s. 3d.</u> | 77. <u>427 at 5s. 9d. per Yard.</u> |
| 78. <u>402 at 10s. 8½d.</u> | 79. <u>174 at 17s. 9½d.</u> |
| 80. <u>273 at 19s. 4¼d.</u> | 81. <u>260 at 14s. 11¾d.</u> |

8. When the Price is Pounds only.

R U L E.

Multiply the given Quantity by the Price, and the Product will be the Answer.

E X A M P L E S.

- | | |
|-----------------------|--------------------------------|
| 82. <u>120 at 4l.</u> | 83. <u>96 at 17l. per cwt.</u> |
| 84. <u>100 at 3l.</u> | 85. <u>142 at 42l.</u> |

9. When the Price is Pounds and Shillings.

R U L E.

Multiply the Quantity given by the Pounds, as in the last Case, and proceed with the Shillings; if they are even, as in Case IV. but if odd, take aliquot Parts, add them together, the Sum will be the Answer; or reduce the given Price to Shillings, by which multiply the given Quantity, and divide by 20, will give the Answer.

E X A M P L E S.

- | | | |
|---------------------------|----------------------------|----------------------------|
| 86. <u>649 at 2l. 6s.</u> | 87. <u>526 at 7l. 16s.</u> | 88. <u>142 at 1l. 17s.</u> |
| | | 89. 164 |

89. 164 at 24l. 19s. 90. 271 at 5l. 7s. 91. 604 at 20l. 9s.

92. 914 at 10l. 15s. 93. 737 at 1l. 14s.

10. When the Price is Pounds, Shillings, and Pence, and the Shillings and Pence be an aliquot Part of a Pound.

R U L E.

Multiply the given Quantity by the Pounds, as in the last Rule; and take Parts for the Shillings and Pence, as in Case VI. add them together, and the Sum will be the Answer.

E X A M P L E S.

94. 274 at 7l. 6s. 8d. 95. 120 at 12l. 3s. 4d.

96. 97 at 9l. 1s. 8d. 97. 512 at 42l. 5s.

11. When the Price is Pounds, Shillings, Pence, and Farthings, and the Shillings and Pence be not an aliquot Part of a Pound.

R U L E.

Reduce the Pounds and Shillings into Shillings, multiply the given Quantity by the Shillings, as in Case IX. take Parts for the Pence and Farthings as in Case II.
Note. When the given Quantity doth not exceed 100, proceed as in Sect. 9.

E X A M P L E S.

98. 1472 at 4l. 6s. 7½d. 99. 279 at 6l. 11s. 9¾d.

100. 1420 at 19l. 14s. 11¾d. 101. 2074 at 1l. 17s. 5½d.

102. 27 at 4l. 11s. 8¼d. 103. 64 at 12l. 13s. 7¼d.

12. When the Price and Quantity given are of several Denominations.

R U L E.

R U L E.

Multiply the Price of one, by the Quantity given, and take Parts for Quarters, Pounds, &c. add them together, and the Sum will be the Answer.

E X A M P L E S.

104. Bought 7 cwt. 3 qrs. 18 lb. of Sugar, at 17s. 6d. per cwt. what comes it to?
 105. Sold 420 oz. 15 dwts. 16 grs. of Gold, at 3l. 16s. 10 $\frac{1}{2}$ d. per Ounce, &c.
 106. Bought Tobacco at 3l. 17s. 4 $\frac{1}{2}$ d. per cwt. what is the Worth of 72 cwt. 3 qrs. 19 lb.
 107. Bought 12 cwt. 1 qr. 17 lb. of Hops, at 4l. 4s. 4d. per cwt. what do they stand me in?
 108. Sold 23 cwt. 18 lb. of Sugar, at 4l. 14s. 1 $\frac{1}{2}$ d. per cwt. what comes it to?
 109. What is the Rent of 476 Acres, 3 Roods, 28 Perches, at 3l. 7s. 11d. per Acres?
 110. Sold 16 cwt. 2 qrs. of Tallow, at 2l. 6s. 11d. per cwt. what comes it to?
 111. Sold 48 cwt. 2 qrs. 7lb. of fine Hyson Tea, at 74l. 16s. 6d. per cwt. what must I receive for the same?
 112. What is the Value of 24 lb. of double-refined Sugar, at 4l. 17s. per cwt.?
 113. What is the Value of 17 lb. of Malaga Raisins, at 3l. 5s. 4d. per cwt.?

When the Pupil is perfect in all the Rules to the foregoing Cases, he may then be taught the Contractions.

E X A M P L E S.

1. 1276 at $\frac{3}{4}$ d. 2. 1740 at 2 $\frac{3}{4}$ d. 3. 1420 at 7 $\frac{1}{2}$ d.
 4. 3162 at 1s. 7d. 5. 427 at 5s. 9d. 6. 246 at 17s. 10 $\frac{1}{2}$ d.
 7. 241 at 7l. 19s. 8. 641 at 1l. 14s.

16. T A R E and T R E T T.

In this Rule there are six Things to be observed, viz.
 1. The

1. The Gross Weight. 2. Tare. 3. Trett. 4. Suttle
5. Cloff. 6. Net Weight.

1. The Gross Weight is, the Whole Weight of the Goods, and that which they are packed up in.
2. Tare is an Allowance made to the Purchaser for the Weight of the Box, Bag, Barrel, or whatever contains the Goods bought, and is either
At so much in the whole Gross Weight.
At so much per Box, Bag, &c. or
At so much per Cent.
3. Trett is an Abatement of 4 lb. per 104 lb. and is the twenty-sixth Part allowed for Waste, Dust, &c. made by the Merchant to the Buyer.
4. Suttle is when the Tare is deducted from the Gross.
5. Cloff is an Allowance of 2 lb. to the Citizens of London on every Draught above 3 cwt. on some Sorts of Goods, as Beaver, Galls, Madder, Argol, &c.
6. Net Weight is when all Allowance is deducted from the Gross.

1. When the Tare is at so much in the Gross Weight, to find the Net.

R U L E.

Subtract the Tare from the Gross, and the Remainder is the Net Weight.

E X A M P L E S.

1. What is the Net Weight of 24 Hogheads of Tobacco, each weighing 6 cwt. 2 qrs. 17 lb. Gross. Tare in the Whole 17 cwt. 3 qrs. 27 lb.
2. What is the Net Weight of 5 hhds. of Sugar, weighing as follows, viz.

	cwt. qrs. lb.			qrs. lb.	
No. 1,	4	2	14	Tare 0	21
2,	3	0	17	0	18
3,	5	3	10	1	11
4,	6	1	16	0	27
5,	3	2	18	0	19
Gross					
Tare					
Net					

2. When Tare is at so much per Box, Bag, &c. to find the Net Weight.

R U L E.

Multiply the Tare of each Box, Bag, &c. by the Number of Boxes, &c. the Product subtract from the Gross as before, and the Remainder will be the Net Weight.

E X A M P L E S.

3. What is the Net Weight of 8 Fraills of Raisins, each weighing 2 cwt. 3 qrs. Gross, Tare at 22 lb. per Frail?
4. What is the Net Weight of 40 Bales of Silk, each weighing 3 cwt. 27 lb. Gross, Tare at 18 lb. per Bale?

3. When Tare is at so much per cwt. to find the Net Weight.

R U L E.

Divide the whole Gross by the said Part or Parts, that the Tare is of a cwt. and the Quotient thence arising will be the Tare, which subtracted from the Gross, as before, will give the Net Weight.

E X A M P L E S.

5. What is the Net Weight of 22 Barrels of Figs each 2 cwt. 1 qr. 17 lb. Gross, Tare at 14 lb. per cwt.?
6. What is the Net Weight of 9 hhds. of Sugar, each weighing 6 cwt. 2 qrs. 12 lb. Gross, Tare at 17 lb. per cwt.?

4. When Trett is allowed with the Tare, to find the Net Weight.

R U L E.

Find the Tare as before, and subtract it from the Gross, the Remainder will be the Suttle, which divide by 26, and the Quotient will be the Trett, which subtract from the Suttle, the Remainder will be the Net Weight.

E X A M P L E S.

E X A M P L E S.

7. What is the Net Weight of 16 cwt. 3 qrs. Gross, Tare 1 cwt. 1 qr. 12 lb. and Trett 4 lb. per 104?
8. In 27 Bags of Coffee, each weighing Gross, 2 cwt. 3 qrs. 27 lb. Tare 13 lb. per 112 lb. and Trett 4 lb. per 104 lb. what is the Net Weight?
5. When Cloff is allowed, to find the Net Weight.

R U L E.

Divide the whole Gross, by 168, 2 lb. being 168th Part of 3 cwt. or 336 lb. or you may divide the Number of cwts. by 3, which brings them into 3 cwts. then 2 lb. being allowed for every 3 cwt. so as many 3 cwts. as it produces, so many 2 lb. it will allow, which divided by 56 (the double Pounds in a cwt.) the Quotient will be the Hundreds, and the Remainder will be so many 2 lb. to which adding what may be allowed for the odd cwts. qrs. and lb. of the given Weight, will make the whole Cloff, which subtract from the Gross will be the Net Weight.

E X A M P L E S.

9. What will be the Net Weight of 5647 cwt. 3 qrs. 13 lb. Gross, allowing for Cloff 2 lb. for every 3 cwt.?
10. What is the Net Weight of 14 Barrels of Spices, weighing all together 42 cwt. 3 qrs. Gross, allowing for Cloff 2 lb. per 3 cwt.?

6. When Tare, Trett, and Cloff, be allowed with any Quantity (Gross) to find the Net Weight.

R U L E.

For the Tare and Trett, proceed as in Case IV. and the Remainder, which was called the Net there, will be the Suttle here, which to find the Cloff of, proceed as in the last Case.

E X A M P L E S.

11. What is the Net Weight of 15 cwt. 3 qrs. 2 lb. Gross, allowing

allowing for Tare 7 lb. per cwt. Trett 4 lb. per 104 lb. and Cloff 2 lb. for 3 cwt.?

82. What is the Net Weight of 4 hhds of Sugar, weighing as follows, viz.

	cwt. qrs. lb.			
No. 1,	4	2	17	} Tare 8 lb. per cwt. Trett 4 lb. per 104 lb. Cloff 2 lb. per 3 cwt.
2,	5	3	14	
3,	3	2	26	
4,	6	2	12	

17. SIMPLE INTEREST

Is that which arises only from the Principal, and is a Profit allowed by the Borrower to the Lender; for the Loan or Forbearance of any Sum of Money, for some determined Space of Time, and at any Rate (per Cent. per Annum) agreed upon; which according to Law must not exceed 5% for the Use or Interest of 100% Principal, called Cent. for 12 Months called Annum.

The Amount is the Principal and Interest added together.

Note. The Rules for Simple Interest, serve also for calculating Factorage, Brokerage, Insurance, purchasing of Stocks, or any Thing else, that is rated at so much per Cent.

To find the Interest of any Sum of Money, for any Number of Years.

R U L E.

Multiply the Principal by the Rate per Cent. that Product divided by 100. will give the Interest for a Year, which multiplied by the Number of Years given, and the Product will be the Answer. Or, by taking the aliquot Part or Parts with the given Rate that are in 100%.

E X A M P L E S.

1. What is the Interest of 824*l.* 18*s.* 2*d.* for a Year, at 4 per Cent. per Annum?
2. What is the Interest of 500*l.* for 4 Years, at 4½ per Cent. per Annum?

3. What

3. What is the Amount of 264*l.* 4*d.* for 12 Years, at 5 per Cent. per Annum?

When the Rate per Cent. is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, more than the Pounds given in the said Rate.

R U L E.

Multiply the Principal by the Pounds in the Rate per Cent. then take Parts for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, from the Principal, which add to the Product, and the Sum divide by 100, as before.

E X A M P L E S.

4. What is the Interest of 246*l.* 18*s.* for a Year, at $4\frac{1}{4}$ per Cent. per Annum?
 5. What is the Interest of 140*l.* 10*s.* for 7 Years, at $4\frac{1}{2}$ per Cent. per Annum?
 6. What is the Amount of 470*l.* for 5 Years, at $3\frac{3}{4}$ per Cent. per Annum?

C O M M I S S I O N.

Is an Allowance from a Merchant to his Factor, or Correspondent abroad, in buying and selling of Goods, and is at a certain Rate per Cent. according to the Custom of the Country, where the Factor resides.

This, as well as Brokerage and Insurance, is computed in the same Manner as for even Pounds, and for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, as in the last Case.

E X A M P L E S.

7. My Factor writes me word, that he has bought Goods, upon my Account, to the Value of 474*l.* 14*s.* 6*d.* I demand to know what his Commission comes to, at $3\frac{1}{4}$ per Cent.?
 8. Suppose I allow my Correspondent $2\frac{1}{2}$ per Cent. for his Commission; what is his Demand, on the Disbursement of 742*l.* 12*s.* 6*d.*

B R O K E R A G E

Is an Allowance or Fee paid unto a Person called a Broker, for assisting others in buying or disposing of their
 † H Goods,

Goods, and in the City of London they are not to act without a Licence from the Lord-Mayor.

3. To find the Brokerage for any Sum, at any Rate under 1%. per Cent.

R U L E.

Divide the given Sum by 100, and it will give the Interest at 1%. per Cent. which Interest you must take Parts from, with the Rate per Cent. and add them together, the Sum will be the Brokerage required.

E X A M P L E S.

9. What is the Brokerage of 420*l.* 12*s.* 6*d.* at 6*s.* 4*d.* per Cent.?
10. Suppose I employ a Broker, who sells Goods for me, to the Value of 1000*l.* what may he demand for Brokerage, it being at 4*s.* 6*d.* per Cent.?
11. Suppose a Broker disposes of Goods for me, to the Amount of 540*l.* 10*s.* what comes the Brokerage to, at 13*s.* 10*d.* per Cent.?
12. What is the Brokerage of 2474*l.* 15*s.* at 19*s.* 9½*d.* per Cent.?

I N S U R A N C E

Is a Contract or Agreement whereby one or more Persons, called Insurers, &c. oblige themselves to answer for the Loss or Damage of Ships, Houses, Goods, &c. by Storms, Fires, &c. in Consideration of a Premium, paid by the Proprietors of the Thing Injured.

To find the Insurance of any Sum, at any Rate under 1%. proceed as in the last Case, if above, as in Case I.

E X A M P L E S.

13. Suppose I insure for 1460*l.* at 2*s.* 6*d.* per Cent. per Annum, what doth the Insurance come to?
14. What is the Insurance of 2460*l.* at 10*l.* 15*s.* per Cent.?
15. Shipped at Jamaica, Goods to the Value of 2500*l.* upon which I made an Insurance at 6¾*l.* per Cent. what does it come to?

16. What

16. What is the Insurance of an East India Ship and Cargo, valued at 740*l.* 17*s.* 6*d.* at 15 $\frac{1}{4}$ *d.* per Cent.?

PURCHASING of STOCKS.

Stocks are the public Funds of the Nation, the Shares of which being transferable from one Person to another, occasions that extensive Business called Stock-Jobbing.

R U L E.

Multiply the Sum to be purchased, by the Excess of the Rate per Cent. above 100, the Product divide by 100, as before, and the Quotient added to the given Sum, will give the required Purchase.

If under Par, i. e. if under 100 per Cent. proceed as in Case II.

E X A M P L E S.

17. What is the Purchase of 400*l.* South Sea Stock, at 120*l.* 5*s.* per Cent.?
 18. What is the Purchase of 470*l.* Bank Stock, at 87 $\frac{1}{4}$ per Cent.?
 19. What is the Purchase of 2470*l.* 17*s.* 10*d.* Bank Annuit-
 ties, at 103 $\frac{1}{2}$ per Cent.?
 20. What is the Purchase of 876*l.* India Stock, at 114 $\frac{5}{8}$ per Cent.?

4. When the Interest is for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a Year, or any Number of Years besides.

R U L E.

Find the Interest for the Years, as in Case I. then for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, take Parts from the Interest of 1 Year, i. e. for $\frac{1}{4}$, take one-fourth Part of the said Interest, for $\frac{1}{2}$, take one-half, and for $\frac{3}{4}$, take the Parts compounded of $\frac{1}{4}$, that is, a half for $\frac{1}{4}$, then half of that half for $\frac{1}{8}$, which added to the Interest for Years (if any) the Sum will be the Interest required.

E X A M P L E S.

21. What is the Interest of 427*l.* 10*s.* for four Months, at 4 per Cent. per Annum?
 22. What is the Interest of 246*l.* 12*s.* 6*d.* for $1\frac{1}{4}$ Year, at 5 per Cent. per Annum?
 23. Lent 209*l.* 18*s.* upon a Mortgage, to receive Interest for the same, at $4\frac{1}{4}$ per Cent. per Annum, till it was paid off, which was not till the End of $4\frac{1}{2}$ Years after, now I should be glad to know what's due to me?
 24. A Gentleman dying left his Daughter 604*l.* 17*s.* 6*d.* for her Fortune, to be paid her, when at Age, with Interest, at $5\frac{1}{2}$ per Cent. per Annum. Now she came to Age in 3 Years, 9 Months, after her Father's Death: What is the Amount of her Fortune, that is, what is she to receive in all, Principal and Interest?
5. When the Interest required is for any Number of Weeks.

R U L E S.

1. Find the Interest of the given Sum for a Year, as in Case I.
2. Say as 52 Weeks : are to that Interest of the given Sum : : so are the Weeks given : to the Interest required. Or you may divide the given Weeks into aliquot Parts of a Year, or 52 Weeks.

E X A M P L E S.

25. What is the Interest of 400*l.* 15*s.* for 4 Weeks at 4 per Cent. per Annum?
26. What is the Amount of 600*l.* for 26 Weeks, at $3\frac{1}{4}$ per Cent. per Annum?
27. What is the Interest of 740*l.* for 4 Years and 42 Weeks, at 5 per Cent. per Annum?
28. What is the Amount of 200*l.* for 5 Years and 50 Weeks, at $4\frac{1}{2}$ per Cent. per Annum?

6. To find the Interest of any Sum, for any Number of Days.

R U L E

R U L E.

1. Say as 365 Days : are to the Interest of the given Sum for a Year : : so are the Days given : to the Interest required.

2. (When convenient) divide the Days into aliquot Parts of a Year, or 365.

E X A M P L E S.

29. What is the Interest of 200*l.* for 73 Days, at $3\frac{1}{2}$ per Cent. per Annum?
30. What is the Amount of 340*l.* 10*s.* from January 1, 1779, to July 18 following, at 5 per Cent. per Ann.?
31. What is the Interest 500*l.* from December 4, 1779, to March 10, 1781, at 4 per Cent. per Annum?

When the Amount, Time, and Rate per Cent. are given, to find the Principal.

R U L E S.

7. 1. Say, as the Amount of 100*l.* at the Rate and Time given : is to 100*l.* : : so is the Amount given : to the Principal required. Or,

2. The Examples in this and the two following Cases may be solved by the Rule in Sect. XV.

E X A M P L E S.

32. What Principal, being put to Interest for $9\frac{1}{2}$ Years, at $4\frac{1}{2}$ per Cent. per Annum, will amount to 856*l.* 10*s.*
33. What Principal, being put out to Interest for $7\frac{1}{4}$ Years, will amount to 614*l.* 3*s.* 11*d.* at 3 per Cent. per Ann.?

8. When the Principal, Rate per Cent. and the Amount are given, to find the Time.

R U L E.

Say, as the Interest of the Principal for a Year : is to 1 Year : : so is the whole Interest : to the Time required.

E X A M P L E S.

34. In what Time will 600*l.* amount to 856*l.* 10*s.* at $4\frac{1}{2}$ per Cent. per Annum ?
 35. In what Time will 496*l.* 6*s.* 8*d.* amount to 614*l.* 3*s.* 11*d.* at 3 per Cent. per Annum ?

9. When the Principal, Amount, and Time are given, to find the Rate per Cent.

R U L E S.

1. Say, as the Principal : is to the Interest, for the whole Time : : so is 100*l.* to the Interest for the same Time.
2. Divide that Interest by the given Time, and the Quotient will be the Rate per Cent. required.

E X A M P L E S.

36. At what Rate per Cent. per Annum, will 600*l.* amount to 856*l.* 10*s.* in $9\frac{1}{2}$ Years ?
 37. At what Rate per Cent. per Annum, will 498*l.* 6*s.* 8*d.* amount to 614*l.* 3*s.* 11*d.* in $7\frac{3}{4}$ Years ?

18. COMPOUND INTEREST.

Is that which arises both from Principal and its Interest put together, as the Interest becomes due, but not paid ; the same Interest is allowed upon that Interest unpaid, as was upon the Principal, so it becomes a Part of the Principal ; and for which Reason it is called Interest upon Interest, or Compound Interest.

It is not lawful to let out Money at Compound Interest, yet in purchasing of Annuities or Pensions and Leases in Reversion,

Reversion, it is usual to allow Compound Interest to the Purchaser for his Ready Money, and therefore makes it necessary that it should be understood.

R U L E.

1. Find the first Year's Interest as in Case I. add that Interest to the Principal, which Sum will become the second Year's Principal, and so on for any Number of Years.
2. Subtract the given Principal from the last Amount, and the Remainder will be the Interest required.

E X A M P L E S.

1. What is the Compound Interest of 600*l.* forborne 3 Years at 5 per Cent. per Annum?
2. What is the Amount of 150*l.* for 5 Years at 4 per Cent. per Annum, Compound Interest?
3. What is the Compound Interest of 440*l.* 16*s.* for 4 Years, 7 Months, and 15 Days, at 5 per Cent. per Annum?

Note. When the Interest is required for Months and Days besides Years, you must find the Interest for one Year more than the Number of Years given, and from that Year's Interest, take Parts from, for the Months and Days, which add to the last Year's Interest, and the Sum will be the Interest required.

19. R E B A T E, or D I S C O U N T,

Is the abating of so much on a Debt, to be paid before it becomes due, which Payment (Rebate being deducted) if put out to Interest for the same Time and Rate per Cent. per Annum, would be equal to the Sum first due.

R U L E S.

1. Find the Interest of 100*l.* for the Time given, and Rate per Cent. which Interest add to 100*l.*
2. As that Sum : is to the Interest of the 100*l.* or to 100 : : so is Debt or Sum proposed : to the Rebate or present Worth required. Or subtract the Rebate from the given

given Sum, and the Remainder will be the present Worth, or Money to be paid down.

E X A M P L E S.

1. What is the Rebate of 420*l.* for 7 Months, 6 Days, at 5 per Cent. per Annum?
2. What is the present Worth of 100*l.* for 12 Months, at 6 per Cent?
3. What is the Rebate and present Worth of 600*l.* 10*s.* 6*d.* payable in 10 Months, at 4 per Cent. per Annum?
4. What is the Discount of 800*l.* 16*s.* being due July 27, 1784, this being December 12, 1783, at 5 per Cent. per Annum?
5. Sold Goods to the Value of 430*l.* to be paid at two 4 Months, that is, Half at 4 Months, and the other Half at 8 Months: what must be discounted for the present Payment of the Whole, Discount being at 5 per Cent. per Annum?
6. Suppose I have a Legacy of 550*l.* left me on the 21st of May, 1784, but not to be paid till Christmas-Day following; what is the present Worth, Discount allowed, at 5 per Cent. per Annum?

20. EQUATION of PAYMENTS,

Is when several Debts are payable at different Times, but is mutually agreed between Debtor and Creditor, that all those several Sums be paid at once, and at such a Time as, that neither Party may be wronged thereby, this is called equating the Time of Payment. The common Rule is as follows.

R U L E.

Multiply the Sum of each particular Payment by its Time, then add the Products together, and divide the Sum by the whole Debt, the Quotient (by this Rule) is the equated Time for the Payment of the Whole.

E X A M P L E S.

1. B. owes C. 600*l.* whereof 200*l.* is to be paid at 3 Months, 150*l.* at 4 Months, and the rest at 6 Months; but they

they afterwards agreed the Whole should be paid at once, required the Time?

2. A. bought of B. a Quantity of Goods, which came to 460*l*. to be paid in the following Manner, viz. 200*l*. at 7 Months, and the rest at 5 Months, but afterwards they agree to make one Payment of the Whole; I demand the equated Time?
3. C. owes D. a certain Sum, which is to be discharged in the following Manner, viz. $\frac{1}{2}$ at 3 Months, $\frac{1}{3}$ in 4 Months, and $\frac{1}{6}$ at 9 Months, but they afterwards agree to have but one Payment of the Whole: the equated Time is required?
4. A Debt is to be discharged thus, viz. $\frac{1}{4}$ present, $\frac{1}{4}$ at 4 Month, $\frac{1}{4}$ at 5 Months, and the rest at 6 Months, what is the equated Time for the Whole?
5. E. is indebted to F. 240*l*. which by Agreement is to be paid at 5 Months hence; but E. is willing to pay him 40*l*. down, provided he will give him a longer Time for the Payment of the Remainder, which is agreed on. the Time of Payment is required?

21. SINGLE FELLOWSHIP;

O R,

FELLOWSHIP WITHOUT TIME,

Is when two or more Persons join their Stocks, and Trade together: To determine each Person's particular Share of the Gain or Loss, in Proportion to his Principal paid into the Stock, observe the following,

R U L E.

As the Sum of the several Stocks : to the Gain or Loss,
: : so is each Person's Share in the Stock : to his Share of the Gain or Loss.

P R O O F.

Add all the Shares together, and that Sum (if right) will be equal to the whole Gain or Loss.

E X-

E X A M P L E S:

1. Two Merchants, A. and B. join in Partnership; A. lays in 80*l.* B. 60*l.* and they gain 28*l.* what is each Man's Share of the said Gain?
2. Three Persons, C. D. and E. trade together, and make a joint Stock of 824*l.* and in three Years Time they gained as much, and 70*l.* over; C.'s Stock was 320*l.* D.'s 340*l.* I demand E's Stock, and what each Person gained by trading?
3. Suppose four Merchants, A. B. C. and D. join their Stocks and Trade together, of which A. put in $\frac{1}{2}$, B. $\frac{1}{3}$, C. $\frac{1}{4}$ and D. $\frac{1}{5}$, but, at the Expiration of 12 Months, they had the Misfortune to lose 120*l.* what much each Person suffer of the said Loss?
4. Three Merchants, D. E. and F. in Partnership together, and with one common Stock of 400*l.* they gained as follows, viz. D. 30*l.* E. 48*l.* and F. 42*l.* what was each Man's Stock?
5. Suppose the Money and Effects of a Bankrupt, amounted to 2420*l.* 17*s.* 6*d.* and he is indebted as follows, viz. to A. 1000*l.* to B. 640*l.* to C. 900*l.* and to D. 842*l.* 16*s.* how must his Effects be divided amongst them, that is, what must each have?

22. DOUBLE FELLOWSHIP;

O R,

FELLOWSHIP WITH TIME,

Is when each Person's Stock continues unequal Time in Company, so that a Consideration must be made of the Time, as well as of the Stock.

R U L E.

Multiply each Person's Stock by the Time it has continued in Trade, and proceed with the Products, as with the particular Stocks in Single Fellowship.

P R O O F.

P R O O F.

As in Single Fellowship.

E X A M P L E S.

1. Three Merchants, A. B. and C. enter into Partnership, thus; A. puts into the Stock 240*l.* for 4 Months, B. 120*l.* for 6 Months, and C. 200*l.* for 8 Months; with this Joint Stock they traffic and gain 260*l.* it is required to find each Person's Share of the Gain, proportionable to his Stock and Time of employing it?
2. A Ship's Company take a Prize, Value 4000*l.* which they agree to divide amongst them, according to their Pay and Time they have been on board; now the Officers and Midship Men have been on board 4 Months, and the Sailors 3; the Officers have 50*s.* a Month, the Midship-men 40*s.* and the Sailors 28*s.* moreover, there are 4 Officers, 8 Midship-Men, and 120 Sailors: I demand to know what each Person's Share is of the said Prize?
3. A. B. and C. rent a Piece of Land, for which they pay 40*l.* per Annum; A. puts in 60 Oxen for 4 Months, B. 40 Oxen for 5 Months, and C. 30 Oxen for the Remainder of the Year, what must each Person pay of the said Rent?
4. Three Merchants, A. B. and C. in Partnership together for a Year, put into one common Stock as follows, viz. A. put in 400*l.* and at 6 Months End withdraws 200*l.* B. puts in 360*l.* and at 7 Months End 100*l.* more, but at the End of 9 Months he takes out 120*l.* C. puts in 190*l.* and at 8 Months End 110*l.* more, but at the End of 10 Months he takes out 100*l.* they gain 460*l.* what is each Man's Share?

23. B A R T E R

Is the changing of one Commodity for another, and informs us how to Proportion the Value of any Goods, so that neither Party may sustain Loss. And if the Commodities exchanged are not of equal Value, the Defect is supplied with Money.

R U L E.

R U L E S.

1. Find the Value of that Commodity, whose Quantity is given, then find what Quantity of the other, at the given Rate, you can have for the aforesaid Value, which Quantity will be the Answer.

2. When one has Goods at a certain Price Ready Money, but in Barterage advances it to something more, say, As the Ready Money Price of the one : is to its Bartering Price :: so is the Ready Money Price of the other to its Bartering Price ; then the Quantity of the latter Commodity may be found either from the Ready Money, or Bartering Price.

E X A M P L E S.

1. How much Sugar, at 1*l.* 10*s.* per cwt. must be given in Barter, for 4 cwt. of Tea, at 12*s.* per Pound ?
2. How many Yards of Cloth, at 18*s.* per Yard, must I give for 45 Yards of Shalloon, at 16*d.* per Yard ?
3. A. and B. Barter : A. hath 30 cwt. of Prunes, at 6*d.* per lb. Ready Money, but in Barter will have 7½*d.* per lb. B. hath Hops worth 36*s.* per cwt. Ready Money ; what ought B. to rate his Hops in Barter, and what Quantity must be given for the 30 cwt. of Prunes ?
4. A. hath Tea at 8*s.* 6*d.* per lb. ready Money, but in Barter will have 10*s.* per lb. B. hath Tobacco worth 18*d.* per lb. ready Money ; how must B rate his Tobacco per lb. that his Profit may be equivalent with A.'s.

24. L O S S and G A I N

Is a Rule by which we discover the Gain or Loss by any Parcel of Goods, and so instructs us how to raise or fall the Price of any Commodity in such Proportion, that neither our Gain may be so exorbitant as to injure our Customers, nor our Loss so great as to impoverish ourselves ; which is generally at so much per Cent.

In this Rule there are great Variety of Examples, all of which may be easily solved (with a little Consideration) by the following Proportion.

When

When the Quantity lost and gained of the Whole is given, to find the Value of any Part thereof.

R U L E.

Say, as the whole Quantity of Goods : is to the Sum of the whole Cost and proposed Gain : : so is any Part of said Goods : to the Price they must be sold for.

When the proposed Gain or Loss is at so much per Cent. make 100%. with the Gain or Loss added to it, your 2d Term.

E X A M P L E S.

1. Bought 240 Yards of Cloth, at 14s. 6d. per Yard, and sold it again at 18s. per Yard. What did I gain by the Whole?
2. Suppose I give 4⁶/₇l. for 9 cwt. 2 qrs. 18lb. of Sugar, at what Rate must I sell it at per lb. to gain 12 Guineas by the Whole?
3. If I buy Tea at 8s. 6d. per lb. and sell it again for 10s. 6d. what is the Gain per Cent.?

The five following Examples, in the Authors mentioned, are wrong answered; which is the Reason of my inserting them here;—the Error consists in the stating the Question, by making the Gain or Loss of 100% the 2d Term, instead of its Amount.

4. If by selling Cloth at 5s. per Ell, I gain 8l. per Cent. what shall I gain per Cent. if I sell the Ell at 6s. 3d.? (*Webster*, 2d Ed. p. 32.)
5. At 5s. per Dozen, I gain 7l. 10s. per Cent. how much shall I gain per Cent. if I sell the Dozen at 5s. 9d.? (*Stonchouse*, 2d Edit. p. 103.)
6. A Manchester Tradesman going to a Fair, sold Fustians for 11s. 6d. the End, wherein was gained 15l. per Cent. but seeing no other Tradesman had so good, raised them, at the latter End of the Fair, to 12s. the End; I demand what he gained per Cent. by this last Sale? (*Hil.* p. 289.)
7. Suppose I sell 500 Deals at 15d. per Piece, and 9l. per Cent. Loss; what do I lose by the whole Quantity? (*Dilworth*, 2d Edit. p. 73.)

† I

8. Suppose

8. Suppose I sell 1 cwt. of Hops for 6*l.* 1*s.* and gain 25*l.* per Cent. what would have been the Gain per Cent. if I had sold them for 8*l.* per Cent.? (*Walkingham*, 3d Edit. p. 70.)
9. If by selling Hops at 3*l.* 10*s.* per cwt. the Planter clears 30 per Cent. what was his Gain per Cent. when the same Goods sold for 4*l.* and a Crown?
10. Sold a repeating Watch for 50 Guineas, and by so doing lost 17 per Cent. whereas I ought in dealing to have cleared 20 per Cent. then how much was it sold under the just Value?

25. A L L I G A T I O N M E D I A L,

Is when the Price and Quantity of several Commodities are given to be mixed, to find the mean Price of that Mixture.

R U L E.

As the whole Composition : is to its total Value :: so is any Part thereof : to its mean Price.

P R O O F.

Find the Value of the whole Mixture at the mean Rate, and if it agrees with the Total Value of the several Quantities at their respective Prices, the Work is right.

E X A M P L E S.

1. A Wine-Merchant mingles 14 Gallons of Mountain Wine, at 8*s.* per Gallon, with 12 Gallons at 6*s.* per Gallon, 10 Gallons of Sherry at 7*s.* per Gallon, 20 Gallons of White Wine, at 4*s.* per Gallon, and 8 Gallons of Canary, at 9*s.* per Gallon: How may he sell this Mixture per Gallon?
2. With 13 Gallons of Canary, at 6*s.* 8*d.* a Gallon, I mingled 20 Gallons of White Wine, at 5*s.* a Gallon; and to these add 10 Gallons of Cyder, at 3*s.* a Gallon: At what Rate must I sell a Quart of this Mixture, so as to clear 10 per Cent.?

26. ALLIGATION ALTERNATE,

Is when the Rates of several Commodities are given, to find such Quantities of them, as being mixed together shall bear a Price propounded.

R U L E S.

1. The Rates (if not already) must all be reduced to one Denomination.

2. Set down the Rate, or Prices, in a Column under one another, and the mixed or mean Rate on the left Hand of these.

3. Connect or link together the several Rates, so that every one less than the mean, be linked with some one greater, or with as many as you please, that are greater, and every great with one less, or with as many less as you please.

4. Take the Difference between each Price and the mean Rate, and set them alternately, and if only one Difference stand against any Rate, it will be the Quantity belonging to that said Rate; but if there are several, then their Sum will be the Quantity, which Quantities are the Answer for that Rate, against which they stand.

E X A M P L E S.

3. To mix Gold of 18 Carrats fine with that of 23 Carrats fine, of 19, and of 16 Carrats fine, so that the Composition may be 20 Carrats fine; what Quantity of each must be taken?

4. A Grocer would mix a Quantity of Sugar at 10*d.* per lb. with other Sugars, at 7½*d.* 5*d.* and 4½*d.* per lb. intending to make up a Commodity worth 6*d.* per lb. In what Proportion is he to take of those Sugars?

27. ALLIGATION PARTIAL,

Is when the Price of each Simple is given, also the Quantity of one of them, and the mean Rate, to find the several Quantities of the Rest in Proportion to that given.

R U L E S.

1. Take the Difference between each Price and the mean Rate as in the last Rule.
2. As the Difference of that Simple, whose Quantity is given : is to the known Quantity :: so is any other Difference : to the Quantity of its opposite Name.

E X A M P L E S.

5. How much Tea at 6*s.* 6*d.* 7*s.* 6*d.* and 9*s.* per lb. must be taken to be mixed with 36 lb. at 12*s.* per lb. that the Mixture may be worth 8*s.* per lb.?
6. A Tobacconist has by him 120 lb. of fine Oroonoko Tobacco, worth 2*s.* 6*d.* a Pound; to this he would mix York-River ditto at 20*d.* and other inferior Tobaccos at 18*d.* and 15*d.* a Pound, as will make up a Mixture answerable to 2*s.* a Pound: What will this Parcel weigh?

28. ALLIGATION TOTAL.

Is when the Price of each Simple is given, as also the mean Rate, and what Quantity of the Compound, to find how much of each Sort will make that Quantity.

R U L E.

1. Take the Difference between each Price, and the mean Rate as before.
2. Say, as the Sum of these Differences : is to the whole Quantity of the Mixture :: so is each particular Difference : to its particular Quantity.

E X A M P L E S.

7. How much Gold of 16, of 18, and 23 Carrats fine, must be mixed together, to form a Composition of 60 oz. of 20 Carrants fine?
8. A Druggist has by him 4 Sorts of Green Tea, viz. of 5*s.* 6*s.* 8*s.* and 9*s.* per lb. out of these he is inclined to mix

mix up a Canister, containing Net a Hundred and a half, so as to make the Commodity worth 7. the Pound. In what Proportion must those Teas be taken?

29. E X C H A N G E.

Is the receiving in one Country for the Value paid in another.

The Par of Exchange is always fixed and certain, it being at the intrinsic Value of any foreign Money compared with Sterling, but the Course of Exchange between any two Countries rises and falls upon various Occasions.

But as it would be both needless and endless to write of every Kind of Exchange; so I shall only give a few Examples of the Exchange of England, with some of the chief Countries of Europe.

Exchange is either performed by Sect. 12, or 15, and sometimes most expeditious by the latter.

1st. With F R A N C E.

They keep their Accounts at Paris, Lyons, and Rouen, in Livres, Sols, and Deniers, and Exchange by the Crown of three Livres Tournois, or 60 Sols French, and give Pence Sterling, more or less, for this Exchange Crown, which is equal to 4s. 6d. at Par.

12 Deniers	} make one	Sol.
20 Sols		Livre.
3 Livres		Crown.

1. To change French Money into Sterling.

R U L E.

As 1 Crown : is to the given Rate :: so is the given French Sum : to the Sterling required ; or by the Rules given in Practice.

2. To change Sterling Money into French.

R U L E.

As the Rate of Exchange : is to 1 Crown :: so is the Sterling Sum : to the French required.

Note. The same Rule must be observed with most of the following Countries.

E X A M P L E S.

1. What Sterling Money must be paid in London, to receive in Paris 500 Crowns; Exchange at 56*d.* per Crown?
2. How many Crowns must be paid at Paris, to receive in London 116*l.* 13*s.* 4*d.* the Exchange at 56*d.* per Crown?
3. Change 640 Crowns, 12 Sols, 8 Deniers, at 54½*d.* per Crown, into Sterling?
4. Change 145*l.* 7*s.* 7½*d.* Sterling, into French Crowns, Exchange at 54½*d.* per Crown?

2*d.* With S P A I N.

They keep their Accounts at Madrid, Cadiz, and Seville, in Dollars, Rials, and Maravedis, and exchange by the Piece of Eight, which is equal to 4*s.* 6*d.* at Par.

4	Maravedis Vellon, or	} make one	{	Quartas.
2	Maravedies Plate			
8	Quartas, or		{	Rial Vellon.
34	Maravedis Vellon			
16	Quartas, or			
34	Maravedis Plate	{	Rial of Plate.	
8	Rials of Plate			
			{	Piece of $\frac{8}{8}$ or Dollar.

N. B. A Rial Vellon is $\frac{17}{32}$ of a Rial of Plate, and $\frac{17}{56}$ of a Piafter.

E X A M P L E S.

5. Change 85*l.* 6*s.* 8*d.* into Spanish Money, Exchange at 56*d.* per Piece of Eight?
6. If I pay in Seville 1426 Pieces of $\frac{8}{8}$, 4 Rials, 26 Maravedis, what may I draw for my Bill at London, Exchange at 54½*d.* per Piece of $\frac{8}{8}$?

3*d.* I T A L Y.

In Italy they keep their Accounts at Genoa and Leghorn, in Livres, Sols, and Deniers, and exchange by the Piece of Eight or Dollar, which is equal to 4*s.* 6*d.* at Par.

12 Deniers

12 Deniers	}	} make one	{	Sol.	{	
20 Sols				Livre.		
5 Livres				Piece of $\frac{3}{8}$ at		Genoa.
6 Livres						Leghorn.

At Florence the Exchange is by Ducatoons, and at Venice by Ducats, divided as follows, viz.

6 Solidi	}	} make one	{	Gross.
24 Grosses				Ducat.

E X A M P L E S.

7. Genoa is indebted to London 640 Dollars, for how much Sterling may London value on Genoa, the Exchange at 52*d.* per Dollar?
8. If a Merchant remits 138*l.* 13*s.* 4*d.* Sterling to Leghorn, how many Dollars will he receive there, the Exchange at 52*d.* per Dollar?

Note. In St. George's Bank at Genoa, Accounts are kept in Piasters or Pezzoes, which are divided into Solidi and Denarii, as the Pound Sterling.

But some Merchants keep their Accounts in Lires, or Liras, Solide, and Deanre, divided, as before: This Money is only one Fifth in Value of the Bank Money.

9. Change 8644 Pez. 2*s.* 6*d.* into Sterling Money, Exchange at 47 $\frac{1}{2}$ *d.* per Pezzoe?
10. London is indebted to Genoa in 1710*l.* 16*s.* 4*d.* or how many Pezzoes may Genoa value on London, the Exchange at 47 $\frac{1}{2}$ *d.* per Pez?

4th. With P O R T U G A L.

They keep their Accounts in Lisbon, Oporto, &c. in Reas, and Exchange on the Milrea, which London gives from 5*s.* to 5*s.* 6*d.* for the same.

400 Reas	}	} make one	{	Crosadoe.
1000 Reas				Milrea.

E X A M P L E S.

11. A Merchant at Lisbon being desirous to remit to his Co-respondent in London 4760 Milreas, Exchange at 64*d.* per Milrea, how much Sterling must be paid in London?

12. How

12. How many Milreas will 1566*l.* 6*s.* 8*d.* amount to, Exchange, at 64*d.* per Milrea?

5th. With HOLLAND, FLANDERS, and GERMANY.

In these Places their Accounts are kept sometimes in Pounds, Shillings, and Pence, as in England, and sometimes in Guilders, Stivers, and Pennings. The Money of Holland and Flander, is distinguished by the Name of Flemish, and the Exchange is made with London, from 30 to 38 Shillings Flemish, per *£.* Sterling.

8 Pennings	} make one {	Groat.
2 Groats		Stiver.
6 Stivers		Shilling.
20 Stivers		Florin, or Guilder.
2½ Florins		Rix Dollar.
6 Florins		Pound Flemish.
5 Guilders		Ducat.

To change Flemish Money into Sterling; and, on the contrary, Sterling into Flemish, is the same with that of France, only what was French there, will be Flemish here.

To reduce Flemish Pounds, Shillings, and Pence, into Guilders.

R U L E.

Reduce them into Pence Flemish, then divide by 40, (because 4*d.* is equal to one Guilder) and the Quotient will be Guilders; and the Remainder (if any) divide by 2, (because 2*d.* is equal to one Stiver) and the Quotient will be Stivers.

E X A M P L E S.

13. A Merchant in Rotterdam remits 564*l.* 10*s.* 6*d.* Flemish, to be paid in London, how much Sterling Money must he draw for, Exchange at 34*s.* 4*d.* per *£.* Sterling?
14. Suppose a Merchant delivered in London 328*l.* 16*s.* 11½*d.* to receive the Value at Amsterdam in Flemish Money; how many Pounds must he receive there, the Exchange at 34*s.* 4*d.* Flemish per *£.* Sterling?

15. What may I draw my Bill for to London, if I pay in Antwerp 4200 Guilders, 12 Stivers, 8 Pennings, Exchange at 33s. 3d. Flem, per £. Sterling?
16. If I pay in London 421l. 2s. 3d. how many Guilders may I draw my Bill for at Antwerp, Exchange at 33s. 3d. Flem. per £. Sterling?
17. Exchange 242l. 13s. 6d. Flemish into Guilders, Stivers, &c.

6th. To Change CURRENT MONEY into BANCO.

R U L E.

As 100 with the Agio added to it : is to 100 Banco :: so is any given Sum current : to the Banco required.

E X A M P L E.

18. Change 495 Guilders, 18 Stivers Current, into Banco Florins, Agio 5 per Cent.

To change Banco into Current Money.

R U L E.

As 100 Guilders Banco : is to 100 with the Agio added to it :: so is the Banco given : to the Current required.

E X A M P L E.

19. Change 470 Guilders, 8 Stivers Banco into Current, Agio at $\frac{5}{8}$ per Cent.?

Note, the Bank Money is worth more than the Current, their Difference is called Agio, and is from three to 6 per Cent in Favour of the Bank.

7. With V E N I C E.

Money of Exchange here is always understood to be that of Ducats in Bank, which is imaginary, 100 whereof make 120 Ducats Current Money; so that the Difference betwixt Bank and Current Money is an Agio of 20 per Cent, though the Brokers have invented another Agio to be added, which is more or less, according to Bargain.

The

The Course of Exchange of a Ducat of the Bank of Venice is from 45*d.* to 50*d.* Sterling.

E X A M P L E.

20. Venice draws on London for 4700 Ducats, 10 Sols, 8 Den. Banco, Exchange at $47\frac{6}{8}$ per Ducat, how much Sterling will pay the Draught?

8th. With P O L A N D and P R U S S I A.

Dantzick and Konigsberg Exchange with London by Way of Amsterdam and Hamburgh; 270 Polish Grosch. being=1*l.* Gros Banco in Holland; 110 Polish Grosch. being=1 Rix-Dollar, Banco of Hamburgh.

18	Phenningen	} make one	Grosch.
3	Grosch		Ditkin.
2	Ditkins		Sixer.
3	Sixers		Tymph.
$7\frac{1}{2}$	Grosch		Arch de Halber.
4	Arch de Halbers		Florin or Guilder.
3	Florins or Guilders		Current } Dollar.
4	Guilders		Specie }

E X A M P L E S.

21. Change 4684 Florins into Sterling Money, 270 Groschi Poli, per Pound Flemish, and 34*s.* 4*d.* Flemish, per £. Sterling?
22. Change 39*l.* Sterling into Florins, the Exchange being 37*s.* 4*d.* Flemish, per £. Sterling, and 270 Groschi Poli, per £. Flemish?

9th. With R U S S I A.

3	Copecs	} make one	Altine.
10	Copecs		Grievener.
25	Copecs		Polpoli on.
2	Polpolitons		Polin.
2	Poltins		Rubble.
2	Rubbles		Ducat.

The Russian Rubbles are converted into Florins Current Money of Amsterdam, and the Current into Bank Money, according

according to Agio of three or five per Cent. and Bank Money into Sterling, according to the Agio of three or five per Cent. and Bank Money into Sterling, according to the Course of Exchange between England and Amsterdam.

E X A M P L E.

23. In 6420 Rubbles, 42 Copecs, Exchange 122 Copecs per Rix-Dollar current, Agio 3 per Cent. and 34^s. 6d. Flemish, per £. Sterling, how much Sterling Money?

10th. With I R E L A N D.

In Ireland they keep their Accounts in £. s. and d. Irish, divided as in England; but having no Coins of their own, they are supplied by the different Countries with which they traffic.

The Par of Exchange between England and Ireland, is 100^l. Sterling, for 108^l. 6^s. 8d. Irish, or 1^s. English = 13d.

The Course of Exchange is from 5 to 12 per Cent. according to the Balance of Trade.

E X A M P L E S;

24. Dublin draws upon London for 74^{cl}. 14^s. 6d. Irish, Exchange at 12 per Cent. how much Sterling must London pay Dublin to Discharge this Bill?
25. London remits to Ireland 65^l. 14^s. 11³/₄d. Sterling; how much Irish must London be credited, Exchange at 12 per Cent?

11th. With AMERICA and the WEST-INDIES.

In Exchange with our Colonies in America and the West Indies. Accounts are kept, and the Money divided, as in England; their Money is called Currency.

The Scarcity of Cash obliged them to substitute a Paper-Currency for carrying on their Trade; which being subject to Casualties, suffer a very great Discount for Sterling, in the Purchase of Bills of Exchange.

E X A M P L E S.

26. Philadelphia is indebted to London 1474*l.* 16*s.* Currency, what Sterling may London reckon to be remitted, when the Exchange is 64 per Cent.?
27. London receives a Bill of Exchange from Philadelphia, for 943*l.* 17*s.* 5½*d.* Sterling; for how much Currency was London indebted, Exchange being at 64 per Cent.?
28. London consigns to Jamaica Goods, per Invoice, amounting to 64*ol.* 16*s.* 9*d.* which are sold for 987*l.* 12*s.* Currency; what Sterling ought the Factor to remit, deducting 5 per Cent. for Commission and Charges; and what does London gain per Cent. upon the Adventure, supposing the Exchange at 30 per Cent.?
29. Jamaica is indebted to London 1470*l.* 12*s.* 8*d.* Sterling; with how much Currency will London be credited at Jamaica, when the Exchange is 56½ per Cent.?

29. Comparison of WEIGHTS and MEASURES,

Is when the Weights or Measures of different Countries are compared together, and is a very necessary Rule (of great Importance to the Merchant) to be acquainted with.

1. When it is required to find how many of the first Sort (of Weight or Measure mentioned in the Question) are equal to a given Quantity of the last.

R U L E.

1. Place the Numbers alternately, beginning at the Left-Hand, and let the last Number stand on the Left-Hand.
2. Multiply the first Rank continually together for a Dividend, and the second for a Divisor.

E X A M P L E S.

1. If 100*lb.* of London are equal to 113*lb.* of Marfeilles, and 100*lb.* at Marfeilles, are equal to 81*lb.* of Amsterdam

- sterdam; how many Pounds at London are equal to 60lb. of Amsterdam?
2. If 104lb. of English, are equal to $84\frac{1}{2}$ lb. of Geneva, and 100lb. of Geneva, are equal to 108lb. at Rouen; how many Pounds English are equal to 64lb. of Rouen?
 3. Suppose 100 yds. English, to be equal to 78 Ells French, and $133\frac{1}{3}$ Ells at Amsterdam; how many Yards English are equal to 100 Ells at Amsterdam?
 4. If 100 Canes of Genoa be equal to $191\frac{1}{3}$ Ells of England, and 78 Ells of Eng. be equal to $131\frac{2}{3}$ of Brussels, how many Canes of Genoa are equal to 100 Ells of Brussels?

2. When it is required to find how many of the last Sort (of Weight or Measure mentioned) are equal to a given Number of the First.

R U L E.

1. Place the Numbers alternately, beginning at the left Hand (as before) and set the last Number on the right-Hand
2. Multiply the first Row for a Divisor, and the other for a Dividend.

E X A M P L E S.

5. Suppose 100lb. of Portugal, be equal to 92lb. of Antwerp, and 100lb. of Antwerp, be equal to 110lb. of Lyons; how many Pounds at Lyons, are equal to 60lb. of Portugal?
6. If 74 Yards of English be equal to 100 Brasses of Florence, and 100 Brasses of Florence be equal to 30 Canes of Marseilles; how many Canes of Marseilles are equal to 100 Yards English?

. 30. P O S I T I O N ;

O R,

The RULE of FALSE:

Is so called, because we suppose some uncertain or false Numbers, in order, that by reasoning from them, according to the Nature thereof, do, by those false supposed Numbers, find the true Number sought.

This Rule is divided into two Parts, commonly called the Single Rule, and Double Rule.

S I N G L E P O S I T I O N.

By Single Position are answered all such Questions, as require only one Suppositi on to discover the true Result.

R U L E.

Make choice of your Position, work with that Supposition, according to the Nature of the Question, as if it were the true Number, and if you find (after ordering your Position) the Result either too much or too little, you may then find the true Answer, by this Proportion, viz.

As the Result of your Position : is to the Position : : so is the given Number : to the Number sought.

P R O O F.

Add the several Parts of the Sum together, and if the Sum agrees with the given Number, it is right.

E X A M P L E S.

1. Three Persons, A. B. and C. discoursing concerning their Ages, says B. to A. I am as old and half again as old as you; then says C. to B. I am twice as old as you; now says A. to them both, I am sure, if our Ages be added together, the Sum will be 152. I demand each Man's Age.
2. A Man, overtaking a Maid driving a Flock of Geese, said to her, How do you do, Sweetheart? Where are you

you going with these 40 Geese? No, Sir, said she, I have not forty, but if I had as many more, half as many more, and 10 Geese besides, I should have 40. How many Geese had she?

3. A. B. C. and D. were in Company together; A. to'd C. that he was older than him by 4 Years; B. told them, that he was as old as both of them together, and 9 Years older; D. hearing them, said, I am just 45 Years old, and that is equal to the Sum of your Ages added together. How old was each of them added together? How old was each of them severally?
4. Three Persons, viz. Andrew, Benjamin, and Christopher, are to go a journey of 469 Miles; of this Journey, Andrew is to go a certain Number of Miles unknown; Benjamin is to go three Times as many Miles as Andrew and one League more; and Christopher is to go twice as many Miles as Benjamin, and 16 Miles more. How many Miles must each of these Persons travel severally?

31. DOUBLE POSITION,

Is when two Suppositions are used; and if we miss in both (as it generally happens) observe the Nature of the Errors, whether they be greater or less than the given Number, and accordingly they must be made use of thus.

R U L E.

1. Place the Error against its respective Position, and multiply them cross wise.

2. If the Errors are alike, that is, both greater, or both less, than the given Number, take their Difference for a Divisor, and the Difference of their Products for a Dividend.

But if unlike, that is, one too much, and the other too little, then take their Sum for a Divisor, and the Sum of their Products for a Dividend, the Quotient will be the Answer.

E X A M P L E S.

1. A Gentleman hath two Horses of good Value, and a Saddle worth 50/. which if set on the Back of the first

† K 2
Horse

Horse will make his Value double that of the second; but if set on the Back of the second Horse makes his Value triple of that of the first Horse. I demand the Value of each Horse?

2. Double my Money for me said A. to B. and I will give thee 6*d.* out of the Stock; with the Remainder he applied in the like Manner to C. with equal Success, and gave him also 6*d.* he repeat d this Proposal to D. and then 6*d.* was all he had to give. Pray, what Sum had he to begin with?
3. Three Gentlemen, A. B. and C. playing at Hazard together, the Money staked was 112 Guineas, but disagreeing, each seized as many as he could; A. got a certain Quantity, B. as many as A. and 16 more; but C. got only a 6th Part of their Sum; how many had each?
4. A Boy stealing Apples was taken by Mad Tom, and to appease him gives half he had, and Tom gives him back 10; in his return home he was met by Raving Ned, who took from him one Half of what he had left, and gave him back 4; after that, unlucky Positive Jack meets him, when he gave him one Half of what he had left, and he returns him back 1; at last getting safe away he finds he has 18 left. How many had he at first?

32. P R O G R E S S I O N

Consists of two Parts,

ARITHMETICAL and GEOMETRICAL.

ARITHMETICAL PROGRESSION,

Is when a Rank or Series of Numbers increase or decrease by a common Difference, or by a continual adding or subtracting some equal Numbers.

As $\left\{ \begin{array}{l} 1, 2, 3, 4, 5, 6, 7, 8 \\ 8, 7, 6, 5, 4, 3, 2, 1 \end{array} \right\}$ Here the common Difference is 1.

Or, 1, 3, 5, 7, 9, 11, 13. Here the common Difference is 2.

Also 35, 30, 20, 22, 15, 10, 5. Here the common Difference is 5.

1. In any Series of Numbers in Arithmetical Progression, when the Number of Terms are even, as 1, 3, 5, 7, 9, 11,

or the like, the Sum of the two Extremes will be equal to the Sum of any two Means that are equally distant from the Extremes.

Viz. 1, 3, 5, 7, 9, 11.

$$1 + 11 = 5 + 7 = 5 + 9 = 12.$$

2. When the Number of Terms are odd, as 2, 4, 6, 8, 10, the Double of the middle Figure or Term will be equal to the Sum of the Extremes, or to any two Means equally distant from the middle Term.

Viz. 2, 4, 6, 8, 10.

$$6 \times 2 = 4 + 8 = 2 + 10 = 12.$$

In Arithmetic Progression there are five Things to be observed, viz.

1. The first Term.
2. The last Term.
3. The Number of Terms.
4. The common Excess or Difference.
5. The Aggregate or Sum of all the Terms.

Any three of which being given, the other two may be found.

PROPOSITION I.

When two Extremes and the Number of Terms are given, to find the Sum of all the Series or Terms.

R U L E.

• Multiply the Sum of the two Extremes into the Number of Terms, and divide the Product by 2. The Quotient will be the Sum of all the Series, or multiply the Sum of the two Extremes by Half the Number of Terms.

E X A M P L E S.

1. How many Strokes do the Clocks at Venice (which go on to 24 o'Clock) strike in the Compass of a natural Day?
2. How many Strokes do the Hammer of a Clock strike in 12 Hours?
3. The Length of my Garden is 94 Feet; now if Eggs be laid along the Pavement a Foot asunder, and be fetched up singly to a Basket, removed one Foot from the first, how much Ground does he traverse that does it?

† K 3

3. Suppose

4. Suppose 100 Stones were placed in a right Line, a Yard distant from one another, and the first Stone was one Yard from a Basket; I demand how many Miles he must travel that gathers them singly into the Basket?
5. A Butcher buys 100 Sheep, and gave for the first Sheep 1s. and for the last 9l. 19s. I demand what he gave for the 100 Sheep?

P R O P O S I T I O N II.

When the two Extremes and Number of Terms are given, to find the common Difference.

R U L E.

The Difference of the two Extremes divided by the Number of Terms less an Unity or 1, the Quotient will be the common Difference.

E X A M P L E S.

6. One had 20 Children that differed alike in their Ages, the youngest was 5 Years old, the eldest 43; what was the Difference of their Ages, and the Age of each?
7. A running Footman (for a Wager) is to travel from London to a certain Place Northwards, in 19 Days and to go but 6 Miles the first Day, increasing every Day's Journey by an equal Excess, so that the last Day's Journey may be 60 Miles: I demand each Day's Journey, and the Distance of the Place he goes to, is from London?
8. A Debt is to be discharged at 10 different Payments in Arithmetical Progression; the first Payment is to be 5l. and the last 50l. What is the whole Debt, and what must each Payment be?

P R O P O S I T I O N III.

When the two Extremes and the common Difference are given to find the Number of Terms.

R U L E.

Divide the Difference of the two Extremes by the common

mon Excess or Difference, add Unity or 1, to the Quotient, and the Sum will be the Number of Terms.

E X A M P L E S.

9. A Man being asked how many Children he had, answered, my youngest Child is 5 Years old, and the eldest 43, and that he had increased one in his Family every two Years; how many Children had he?
10. A Person travelling from London Northward, went 6 Miles the first Day, and increased every Day's Journey 3 Miles, till at last he went 60 Miles in one Day: how many Days did he travel?

P R O P O S I T I O N IV.

When the last Term, the common Difference, and the Number of Terms are given, to find the first Term.

R U L E.

Multiply the Number of Terms less Unity or 1, by the common Difference, the Product subtracted from the last Term leaves the first.

E X A M P L E S.

11. A Man in 10 Days went from London to a certain Place in the Country, every Day's Journey was greater than the preceding one by 3 Miles, his last Day's Journey was 60 Miles, what was the first?
12. A Person takes out of his Pocket, at 10 different Times, so many different Number of Guineas, every one exceeding the former by two, the last was 23, what was the first?

P R O P O S I T I O N V.

When the Number of Terms, common Difference, and the Sum of all the Terms are given, to find the first Term.

R U L E.

Divide the Sum of all the Series by the Number of Terms, and from that Quotient subtract Half the Product of the
common

common Difference, multiplied by the Number of Terms less one, gives the first Term.

E X A M P L E S.

13. A Person is to receive 275/. at 10 different Payments, each Payment to exceed the former by 5/. he is willing to bestow the first Payment on any one that can tell him what it is: What must the Arithmetician have for his Pains?
14. Suppose it is 100 Leagues between London and Edinburgh, two Couriers set out from each Place on the same Road; that from London towards Edinburgh travelling every Day two Leagues more than the Day before; that from Edinburgh to set off one Day after the other, travelling every Day three Leagues more than the preceding one, and that they meet exactly half Way, the first at the End of five Days, and the other at the End of four; how many Leagues did each travel per Day?

P R O P O S I T I O N VI.

When the first Term, Number of Terms, and the common Difference are given, to find the last Term.

R U L E.

Subtract the common Difference from the Product of the Number of Terms, multiplied by the common Difference, the Remainder added to the first Term will give the last.

E X A M P L E S.

15. What is the last Term of an Arithmetic Progression, beginning at 6, and continuing by the Increase of 3 to 19 Places?
16. What is the last Term of an Arithmetic Progression, beginning at 1, and continuing by the Increase of 2 to 100 Places?

P R O P O S I T I O N VII.

The first Term, common Difference, and Number of Terms being given, to find the Sum of all the Series.

R U L E.

R U L E.

From the Product of the Number of Terms in the common Difference, subtract the common Difference, and to the Remainder, add the Double of the first Term; half the Product of that Sum multiplied by the Number of Terms, gives the Sum of all the Series.

E X A M P L E.

17. A Gentleman bargains with a Bricklayer to sink him a Well 30 Yards deep, upon these Terms, viz. to pay him three Shillings for the first Yard, five for the second, seven for the third, &c. raising two Shillings for every Yard: What will be due to the Bricklayer for completing the same?

P R O P O S I T I O N VIII.

The first Term, the Number of Terms, and Sum of all the Terms being given, to find the common Difference.

R U L E.

Divide the double Sum of all the Series by the Number of Terms, and from the Quotient subtract double the first Term; divide the Remainder by the Number of Terms lessened by Unity, the Quotient will be the common Difference.

E X A M P L E S.

18. A Gentleman travelled 200 Miles in eight Days, and every Day travelled equally farther than the preceding Day; it is known that the first Day he travelled six Miles: How many Miles did he travel each of the other Days?
19. A Person travelled from London to York, being 200 Miles, in 9 Days, and every Day travelled equally farther than the preceding Day; it is known that the first Day he travelled 4 Miles: How many Miles did travel each of the other Days?

P R O P O S I T I O N IX.

When one Person or Thing moves with an equal, and another the same Way by a progressive Motion, to find what Time the first will be overtaken.

R U L E.

To double the Space gone each Day by the pursued, add the common Difference of the Pursuer's Day's Journey, from that Sum subtract double the Space he travelled the first Day, and divide the Remainder by the common Difference, the Quotient will give the Number of Days, in which the Pursued will be overtaken by the Pursuer.

E X A M P L E.

27. A noted Highwayman having committed a Robbery, not suspecting a Pursuit, fled Northward at the Rate of nine Leagues a Day; one of Sir John Fielding's Men, upon the Sent, follows him in a progressive Motion, only three Leagues the first Day, five the second, seven the third, and so on, increasing every Day's Journey two Leagues: in how many Days will the Highwayman be overtaken?

33. G E O M E T R I C A L P R O G R E S S I O N,

Is when any Rank or Series of Numbers increase by one common Multiplier, or to decrease by one common Divisor. As 2 . 4 . 8 . 16 . 32 . 64 . here the common Multiplier or Ratio is 2.

Also 729 . 243 . 81 . 27 . 9 . 3 . here the common Divisor or Ratio is 3.

In any Series of Numbers in Geometrical Progression, the Product of the two Extremes are equal to the Product of any two Means that are equally distant from the Extremes.

As 3 . 9 . 27 . 81 . 243 . 729.

Here $3 \times 729 = 27 \times 81 = 9 \times 243 = 2187$.

When the Number of Terms are odd, the middle Term multiplied into itself, will be equal to the Product of the two Extremes, or any two Means equally distant from the said Mean or middle Term.

As

As 3. 6. 12. 24. 48.

$$12 \times 12 = 6 \times 24 = 48 \times 3 = 144.$$

In Geometrical Progression, the same five Things are to be observed, as in Arithmetical Progression, viz.

1. The first Term.
2. The last Term.
3. The Number of Terms.
4. The Ratio.
5. The Sum of the Terms.

Any three of these being known, the Rest may be found.

If to any Series of Numbers in Geometrical Proportion, when the first Term is not an Unit, or the same as Ratio, but not an Unit, and there be assigned a Series of Numbers in Arithmetical Progression, beginning with an Unit or 1, and whose common Difference is 1, called Indices or Exponents.

Thus { 1. 2. 3. 4. 5. 6. 7. Indices.
2. 4. 8. 16. 32. 64. 128. Number in Geometrical Progr.

The Addition or Subtraction of the Indices (or Numbers in Arithmetical Progression) directly correspond with the Product or Quotient of their respective Terms or Series in Geometrical Progression.

That is { As $3 + 6 = 9$
So $8 \times 64 = 512$ the 9th Term in $\div$

Again { As $6 + 6 = 12$.
So $64 \times 64 = 4096$ the 12th Term in $\div$

Or { As $6 - 3 = 3$.
So $64 \div 8 = 8$.

Or { As $7 - 2 = 5$.
So $128 \div 4 = 32$, &c.

But if the Series begin with Unity, or 1, the Indices must begin with a Cypher.

Thus { 0, 1, 2, 3, 4, 5, 6, 7, &c. Indices.
1, 2, 4, 8, 16, 32, 64, 128.

Now by these Indices, and a few of the first Terms, the last Term, or any distant one, may be speedily found, without producing the whole Series.

PROPOSITION I.

When the first Term is Unity, the Ratio and Number of Terms being known, to find the last or any remote Term.

R U L E.

R U L E.

Find a few of the leading Terms, over which place their Indices, as before directed, then find what Figures of the Indices, which added together will give the Index of the Term wanted, multiply the Numbers standing under such Indices into each other, and the last Product will be the Term required.

Note. When the Indices begin with a Cypher, the Sum of the Indices made choice of, must be always one less than the Number of Terms given in Question, as 1 in the Indices stands over the second Term.

E X A M P L E S.

1. A Boy agrees for 16 Oranges, to pay only the Price of the last, reckoning a Farthing for the first, an Half-penny for the second, &c. doubling the Price to the last. How much did he give for them?
2. A Man bought a Horse, and by Agreement was to give what the last Nail would come to, at a Farthing for the first Nail, two for the second, four for the third, &c. there were 4 Shoes, and 9 Nails in each Shoe: I demand the Price of the Horse?

P R O P O S I T I O N II.

In any Series, not proceeding from Unity, the Ratio and first Term being given, to find any remote Term, without producing all the intermediate Terms.

R U L E.

Proceed as in the last Proposition, only observe to divide every Product by the first Term, and the Quotient will be the Term required.

E X A M P L E S.

3. A Person dying left 11 Children, to whom and to his Executor he bequeathed in the Manner following, viz. To his Executor, for seeing his Will performed, 10% the youngest Child to have 30% and so on every Child to exceed the next younger in triple Proportion: What will be the Share of the eldest?

4. A

4. A Nobleman dying left 10 Sons, to whom he left a certain Sum of Money to be divided among them, viz. the youngest Son to have 500*l*. the second to have as much and half as much, and so on every one to exceed the next younger in the same Ratio of $1\frac{1}{2}$. What is the Share of the eldest?

PROPOSITION III.

When the first Term, Ratio, and Number of Terms are given, to find the Sum of all the Terms.

R U L E.

Find the last Term as before, from which take the first, divide the Remainder by the Ratio, less one, and to that Quotient add the last Term, gives the Sum required.

E X A M P L E S.

5. On New-Year's Day a Gentleman married, and received of his Father-in-law a Guinea, on Condition that he was to have a Present on the first Day of every Month for the first Year, which should be double still to what he had the Month before; what was the young Lady's Portion?
6. One, at a Country Fair, had a mind to a String of 20 fine Horses; but not caring to take them at 20 Guineas per Head, the Jockey consented that he should, if he thought good, pay but a single Farthing for the first, doubling it only to the 19th, and he would give the 20th into the Bargain: This being presently accepted, how were they sold per Head?

PROPOSITION IV.

Of any decreasing Series in $\div$, whose last Term is a Cypher, to find the Sum of those Series.

R U L E.

Divide the Square of the first Term by the Difference between the said first Term, and the second Term in the Series, the Quotient will be the Sum of the Series.

+ L

E X-

E X A M P L E S.

9. A great Ship pursues a little one, steering the same Way, at the Distance of four Leagues from it, and sails twice as fast as the small Ship. 'Tis asked how far the great Ship must sail before it overtakes the lesser?
10. Suppose a Ball to be put in Motion by a Force which drives it 12 Miles the first Hour, 10 the second, and so on continually decreasing in Proportion of 12 to 10 to Infinity: What Space would it move through?

34. P E R M U T A T I O N,

O R,

V A R I A T I O N S;

Is the changing or varying the Order of Things, in respect of their Places.

R U L E.

Multiply all the given Terms in a Series of Arithmetical Progressions continually, whose first Term or common Difference is Unity or 1, and the last Term of the Number of Things proposed to be varied together, and the last Product will be the Number of Changes or Variations required.

E X A M P L E S.

1. Six Gentlemen that were travelling, met together by Chance at a certain Inn upon the Road, where they were so pleased with their Landlord, and each other's Company, that in a Frolic they made a contract to stay at that Place, so long as they, together with their Landlord, could sit every Day in a different Order or Position at Dinner. Quere, the Time they staid?
2. I demand the Number of Changes that may be rung on 12 Bells; also, in what Time may they all be rung allowing 3 Seconds to every round, and 365 Days 6 Hours, to the Year?

3. An

3. An Accomptant to'd a Gentleman, who had constantly 8 Persons at his Table, that he would gladly make a ninth, and was willing to give 20 Guineas for his Board, so long as he could place the said Company at Dinner, differently from any one Day before; this being accepted, what did his Entertainment cost him per Year?

1 2 3 4 5 6 7 8 9

T H E
YOUNG ARITHMETICIAN'S
A S S I S T A N T.

P A R T II.

35. VULGAR FRACTIONS.

A FRACTION is a Part or Parts of something considered as an Unit or Integer, and consists in two Parts or Quantities, one wrote over the other with a Line between them, as $\frac{1}{2}$, $\frac{3}{5}$, $\frac{15}{28}$, &c.

The Number placed below the Line is called the Denominator of the Fraction, because it denominates or shews how many Parts the Unit is broken or divided into, and the Number above the Line is called the Numerator, because it enumerates or shews how many of those Parts are contained in the Fraction.

A Vulgar Fraction is either proper, improper, compound, or mixed.

A proper Fraction, is when the Numerator is less than the Denominator, as $\frac{2}{3}$, $\frac{7}{8}$, $\frac{23}{36}$, $\frac{161}{215}$, &c.

An improper Fraction, is such whose Numerator is equal to, or greater than its Denominator, as $\frac{2}{2}$, $\frac{18}{12}$, $\frac{247}{42}$, &c.

A compound Fraction, is the Fraction of a Fraction, and known by the Word of, as $\frac{3}{7}$ of $\frac{7}{8}$ of $\frac{4}{5}$, &c.

A mixed Number is composed of an whole Number and Fraction, as $4\frac{1}{2}$, $12\frac{7}{8}$, $142\frac{1}{5}$, &c.

36. REDUCTION of VULGAR FRACTIONS.

C A S E I.

To reduce a Vulgar Fraction to its lowest Terms.

R U L

R U L E.

Divide the greater Term by the lesser, and that Divisor by the Remainder following, till nothing remains; then by the last Remainder divide both Parts of the Fraction, and the Quotients will give the Fraction required: If the Remainder is 1, the Fraction is already in its least Terms.

E X A M P L E S.

1. Reduce $\frac{336}{898}$ to its least Term.
2. Reduce $\frac{2832}{12848}$ to its lowest Terms.
3. Reduce $\frac{144}{565}$ to its lowest Terms.
4. Reduce $\frac{192}{336}$ to its lowest Terms.
5. Reduce $\frac{1476}{938}$ to its lowest Terms.

When the Numerator and Denominator do each of them end with Cyphers, strike off an equal Number of Cyphers in both, and the remaining Figures will be a Fraction of the same Value, which reduce to its lowest Terms.

E X A M P L E S.

6. Reduce $\frac{19000}{27000}$ to its lowest Terms.
7. Reduce $\frac{4200}{3400}$ to its lowest Terms.

When you discern any Number will equally divide both Numerator and Denominator, you may abbreviate the Fraction thereby.

8. Reduce $\frac{24}{112}$, $\frac{60}{324}$, $\frac{60}{144}$, and $\frac{120}{360}$ to their lowest Terms.

2. To reduce a compound Fraction to a single One.

R U L E.

Multiply all the Numerators together for a new Numerator, and all Denominations for a new Denominator. Reduce the new Fraction to its lowest Terms, by the last Case.

E X A M P L E S.

8. Reduce $\frac{2}{3}$ of $\frac{1}{2}$, to a single Fraction.
9. Reduce $\frac{4}{5}$ of $\frac{5}{7}$ of $\frac{9}{13}$, to a single Fraction.
10. Reduce $\frac{2}{9}$ of $\frac{3}{4}$ of 4, to a single Fraction.
11. Reduce $\frac{3}{7}$ of $\frac{1}{3}$ of $\frac{7}{8}$, to a single Fraction.

3. To reduce whole or mixed Numbers into an improper Fraction.

R U L E S.

1. If the whole Number has no assigned Denominator, an Unity subscribed underneath, must be the Denominator.

2. If the whole Number has an assigned Denominator, multiply the whole Number by the assigned Denominator, and the Product will be the Numerator to the assigned Denominator.

3. If the whole Number has a Fraction annexed, multiply the whole Number by the Denominator of the Fraction, and to the Product add the Numerator for a new Numerator, which place over the Denominator.

E X A M P L E S.

12. Reduce 12, 27, and 176, to Fractions.

13. Reduce 27 into a Fraction, whose Denominator shall be 12.

14. Reduce $4\frac{2}{7}$ to an improper Fraction.

15. Reduce $16\frac{1}{2}$, to an improper Fraction.

16. Reduce $142\frac{17}{3}$, to an improper Fraction.

17. Reduce $146\frac{21}{7}$, to an improper Fraction.

4. To reduce an improper Fraction, into its equivalent or proper Terms.

R U L E.

Divide the Numerator by the Denominator, the Quotient gives the whole Number, and under the Remainder (if any) subscribe the Denominator.

E X A M P L E S.

18. Reduce $\frac{30}{7}$, to its proper Terms.

19. Reduce $\frac{23}{2}$, to its proper Terms.

20. Reduce $\frac{2283}{23}$, to its proper Terms.

21. Reduce $\frac{1423}{37}$, to its proper Terms.

5. To reduce Fractions of different Denominations to Fractions of equal Value, that shall have one common Denominator.

R U L E.

Multiply each Numerator (taken separately) into all the Denominators but its own, and the Products will be the new Numerators: then multiply all the Denominators into one another for a common Denominator.

E X A M P L E S.

22. Reduce $\frac{3}{4}$, $\frac{11}{12}$, and $\frac{7}{10}$, to a common Denominator.
23. Reduce $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of $\frac{7}{8}$, to a common Denominator.
24. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$, to a common Denominator.
25. Reduce $\frac{1}{6}$, $\frac{7}{10}$, $\frac{1}{4}$, and $\frac{1}{4}$ of 3, to a common Denominator.

6. To reduce Fractions of one Denomination to another, retaining the same Value.

R U L E S.

1. If the Fraction given is to be brought from a less to a greater Denomination; multiply the Denominator by the Parts contained in the several Denominations between it, and that you would reduce it to, for a new Denominator, which placed under the given Numerator, will give the new Fraction, which reduce to its lowest Terms.

2. If the Fraction given is to be brought from a greater to a less Denomination, then multiply the Numerator in the same Manner, as you did before the Denominator, and place over the given Denominator, and it will give the new Fraction, which also reduce to its lowest Terms.

E X A M P L E S.

26. Reduce $\frac{3}{4}$ of a Shilling to the Fraction of a Guinea.
27. Reduce $\frac{1}{20}$ of a £. to the Fraction of a Penny.
28. Reduce $\frac{1}{4}$ of a Farthing, to the Fraction of a Moidore.

29. Re-

29. Reduce $\frac{5}{7}$ of a Penny, to the Fraction of a £.
30. Reduce $\frac{1}{1344}$ of a Guinea, to the Fraction of a Farthing.
31. Reduce $\frac{5}{6}$ of a dwt. to the Fraction of a lb. Troy.
32. Reduce $\frac{3}{48}$ of a cwt. to the Fraction of a lb. Avoirdup.
33. Reduce $\frac{3}{4}$ of a Dram, to the Fraction of a cwt.
34. Reduce $\frac{5}{143}$ of a lb. Troy, to the Fraction of a dwt.
35. Reduce $\frac{2}{9}$ of a League, to the Fraction of a Pole.
36. Reduce $\frac{7}{45}$ of a Yard, to the Fraction of a Nail.
37. Reduce $\frac{1}{12}$ of a Gallon of Wine, to the Fraction of a hhd.
38. Reduce $\frac{2}{9}$ of a hhd. of Ale, to the Fraction of a Pint.
39. Reduce $\frac{7}{142}$ of a Chaldron, to the Fraction of a Bushel.
40. Reduce $\frac{3}{5}$ of a Gallon, to the Fraction of a Chaldron.
41. Reduce $\frac{7}{142}$ of a Week, to the Fraction of a Second.
42. Reduce $\frac{1}{11}$ of a Minute, to the Fraction of a Day.

7. To find the proper Quantity or Value of a Fraction in Money, Weights, or Measures.

R U L E.

Multiply the Numerator of the given Fraction, by the Parts contained in the Integer to which it belongs, then divide that Product by the Denominator, and if any Thing remains, reduce it to the next Denomination less, and divide again by the Denominator; thus proceed to the least Denomination.

E X A M P L E S.

43. Reduce $\frac{367}{1296}$ of a Moidore, to its proper Quantity.
44. Reduce $\frac{1}{12}$ of a Guinea, to its proper Quantity.
45. Reduce $\frac{5}{8}$ of a Shilling, to its proper Quantity.
46. Reduce $\frac{4}{7}$ of a Three-Pound-Twelve, to its proper Quantity.
47. What is the Value of $\frac{1}{7}$ of a £.
48. Reduce $\frac{411}{720}$ of a lb. Troy, to its proper Quantity.
49. What is the Value of $\frac{2}{9}$ of a cwt.
50. Reduce $\frac{63}{124}$ of a Ton, to its proper Quantity.
51. What is the Value of $\frac{7}{8}$ of a Mile?
52. Reduce $\frac{1}{2}$ of an Ell English, to its proper Quantity.
53. Reduce $\frac{7}{8}$ of an Acre, to its proper Quantity.

54. What

54. What is the Value of $\frac{11}{25\frac{1}{2}}$ of a hhd. of Wine?
55. Reduce $\frac{2}{9}$ of a Barrel of Beer, to its proper Quantity.
56. Reduce $\frac{2\frac{5}{8}}$ of a Chaldron of Coals, to its proper Quantity.
57. What is the Value of $\frac{2}{5}$ of a Month?
58. Reduce $\frac{5}{7}$ of a Day, to its proper Quantity.

8. To reduce Money, Weights, or Measures into Fractions.

R U L E.

Reduce the given Quantity, to the lowest Name mentioned for a Numerator ; under which, put the Number of those Parts contained in an Unit of the Integer for a Denominator, then reduce the Fraction to its lowest Terms.

E X A M P L E S.

59. Reduce 6s. 8 $\frac{1}{2}$ d. to the Fraction of a Pound.
60. Reduce 4 $\frac{1}{2}$ d. to the Fraction of a Shilling.
61. Reduce 2l. 17s. 7 $\frac{1}{2}$ d. to the Fraction of a Three-Pound-Twelve.
62. Reduce 8s. 2d. to the Fraction of a Guinea.
63. Reduce 6 oz. 17 dwts. 21 grs. to the Fraction of a lb. Troy.
64. Reduce 3 qrs. 3 lb 1 oz. 12 $\frac{1}{2}$ drs. to the Fraction of a cwt.
65. Reduce 10 cwt. 18 lb. 1 oz. $\frac{1}{3}\frac{1}{2}$ to the Fraction of a Ton.
66. Reduce 3 qrs. $\frac{1}{8}$, to the Fraction of an Ell English.
67. Reduce 2 f. 6 in. into the Fraction of a Yard.
68. Reduce 4 fur. 32 p. to the Fraction of a Mile.
69. Reduce 3 r. 2 p. to the Fraction of an Acre.
70. Reduce 42 gal. of Wine, to the Fraction of a hhd.
71. Reduce 28 gal. of Beer, to the Fraction of a Barrel.
72. Reduce 14 bu. 2 p. to the Fraction of a Chaldron.
73. Reduce 1 w. 3 d. 12 h. to the Fraction of a Month.
74. Reduce 243 d. 8 h. to the Fraction of a Year (allowing 365 Days to the Year.)

37. ADDITION of VULGAR FRACTIONS.

R U L E.

1. Reduce the given Fractions to a common Denominator, by Case V. in Reduction.

2. Add

2. Add all the Numerators together for a new Numerator, under which subscribe the common Denominator. And if it is an improper Fraction, reduce it to its proper Terms (by Case IV.) and you have the Sum of all the Fractions.

E X A M P L E S.

1. Add $\frac{3}{7}$, $\frac{1}{4}$, and $\frac{5}{6}$, together.
2. Add $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ together.
3. Add $\frac{2}{3}$ of $\frac{4}{5}$, and $\frac{1}{15}$ together.
4. Add $\frac{3}{7}$ of $\frac{5}{6}$, to $\frac{5}{9}$ or $\frac{3}{4}$.
5. Add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ of $\frac{5}{6}$, into one Sum.

2. To add mixed Numbers.

R U L E.

Reduce the Fractions to a common Denominator, and add them together, as before directed, and annex their Sum, to the Sum of the Integers.

E X A M P L E S.

6. Add $4\frac{1}{2}$ and $17\frac{3}{4}$ together.
7. Add $7\frac{1}{2}$, $9\frac{2}{3}$, and $6\frac{7}{10}$ together.
8. Add $8\frac{1}{2}$, $9\frac{2}{3}$, $10\frac{1}{4}$, $11\frac{3}{5}$, and $12\frac{5}{8}$ into one Sum.
3. When the given Fractions are of several Denominations.

R U L E.

Reduce them to one Denomination (by Case VIII.) then add them together as before directed; or you may reduce them to their proper Quantities (by Case IX.) and add as in Sect. 9.

E X A M P L E S.

9. Add $\frac{201}{460}$ of a £. to $\frac{1}{8}$ of a Shilling.
10. Add $\frac{3}{4}$ of a lb. Troy, to $\frac{3}{4}$ of an oz.
11. Add $\frac{5}{8}$ of an cwt. to $\frac{3}{5}$ of a lb.
12. Add $\frac{3}{4}$ of a Yard, to $\frac{2}{5}$ of an Ell Eng.
13. To $\frac{5}{6}$ of a Mile, add $\frac{2}{3}$ of a Yard.
14. Add $\frac{3}{8}$ of a Chaldron, to $\frac{1}{2}$ of a Peck.
15. To $\frac{3}{4}$ of a Week, add $\frac{5}{6}$ of a Month.
16. Add $\frac{3}{4}$ of an Hour, to $\frac{5}{8}$ of a Week.

17. Add

- 17 Add $\frac{2}{5}$ of 12l. + $4\frac{3}{7}$ l + $\frac{1}{5}$ of $\frac{9}{10}$ of a l. + $\frac{1}{5}$ of $\frac{1}{6}$ of a Shilling into one Sum.

38. SUBTRACTION of VULGAR FRACTIONS.

R U L E.

1. Prepare the Fractions as before directed in Addition.
2. Subtract one Numerator from the other, and their Difference will be a new Numerator, under which, subscribe the common Denominator.

E X A M P L E S.

1. It is required to subtract $\frac{2}{3}$ from $\frac{11}{12}$.
2. From $\frac{10}{64}$ take $\frac{2}{13}$.
3. From $\frac{14}{17}$ take $\frac{7}{11}$.
4. From $\frac{3}{4}$ of $\frac{7}{8}$ take $\frac{2}{5}$.
5. From $\frac{5}{8}$ of $\frac{7}{10}$ take $\frac{2}{3}$ of $\frac{1}{2}$.
6. From $10\frac{3}{4}$ take $6\frac{5}{8}$.
7. From $17\frac{11}{12}$ take $16\frac{6}{7}$.
8. From 12 take $\frac{5}{8}$ of $\frac{7}{8}$ of $\frac{1}{4}$.
9. From $\frac{2}{3}$ of a Shilling take $\frac{1}{4}$ of a Penny.
10. From $\frac{1}{2}$ of a cwt. take $\frac{1}{4}$ of an oz.
11. From $\frac{3}{4}$ of a Yard, take $\frac{3}{8}$ of an Inch.
12. From $\frac{3}{8}$ of a Chaldron, take $\frac{1}{4}$ of a Peck.
13. From $\frac{5}{6}$ of a Day, take $\frac{1}{4}$ of an Hour.

39. MULTIPLICATION of VULGAR FRACTIONS.

R U L E.

1. Prepare the Fractions to be multiplied, i. e. reduce compound Fractions to simple ones, per Case II. bring mixed Numbers into improper Fractions, per Case III. then reduce the Fractions into their lowest Terms.
2. Multiply the Numerators into one another for a new Numerator; and the Denominators into one another for a New Denominator. If the Fractions will cancel, do it as in Case II.

E X A M P L E S.

- | | | |
|--|--|---|
| 1. Mul. $\frac{6}{11}$ by $\frac{7}{12}$. | | 6. Mul. $\frac{3}{4}$ of $\frac{10}{11}$ by 6. |
| 2. Mul. $12\frac{1}{2}$ by 6. | | 7. Mul. $\frac{7}{8}$ of $\frac{3}{4}$ by $\frac{2}{5}$ of $\frac{5}{7}$ of 14. |
| 3. Mul. $17\frac{2}{3}$ by $\frac{7}{8}$. | | 8. Mul. $3\frac{2}{3}$ by $\frac{1}{7}$, and this |
| 4. Mul. $2\frac{1}{4}$ by $\frac{3}{4}$ of $\frac{7}{8}$. | | Product again by $\frac{2}{5}$ of $\frac{3}{4}$. |
| 5. Mul. $12\frac{3}{4}$ by $\frac{7}{8}$ of 12. | | |

40. DIVISION of VULGAR FRACTIONS.

R U L E.

1. Prepare the Fractions as before directed in Multiplication.

2. Multiply the Numerator of the Dividend into the Denominator of the dividing Fraction, for a new Numerator, and multiply the other Numerator and Denominator together for a new Denominator, or invert the Divisor, and then proceed as in the last Rule.

E X A M P L E S.

- | | | |
|--|--|--|
| 1. Divide $\frac{6}{7}$ by $\frac{3}{5}$. | | 6. Divide $7\frac{2}{7}$ by 9. |
| 2. Divide $\frac{1}{11}$ by $\frac{2}{3}$ of $\frac{7}{8}$. | | 7. Divide 96 by $14\frac{6}{7}$. |
| 3. Divide $12\frac{1}{2}$ by $17\frac{2}{3}$. | | 8. Divide $14\frac{3}{7}$ by $\frac{3}{4}$ of 12. |
| 4. Divide $12\frac{3}{4}$ by $3\frac{7}{8}$. | | 9. Divide $142\frac{7}{12}$ by $12\frac{3}{5}$. |
| 5. Divide $\frac{7}{8}$ of $\frac{3}{4}$ by $\frac{2}{5}$ of 12. | | 10. Divide $\frac{7}{8}$ of 6 by $\frac{3}{4}$ of $\frac{6}{7}$ of $\frac{11}{12}$. |

41. The RULE of THREE DIRECT
In VULGAR FRACTIONS.

There are two Methods to perform this Rule, the second of which is the most expeditious and easiest.

R U L E.

1. Prepare the Fractions if required as directed in Multiplication, then proceed as in Sect. 12. or,

2. Having reduced the Fraction and stated the Question, as before directed.

3. Multiply the Denominator of your first Number into the Numerators of the second and third, for a new Numerator;

merator, then multiply the Numerator of the first Number into the Denominator of the second and third, for a new Denominator, and place it under the new Numerator, for an Answer, which reduce to its proper Quantity; or invert the first Term, and then proceed as in Sect. 39.

E X A M P L E S.

1. If $2\frac{2}{3}$ Yards of Silk cost $3\frac{1}{2}l.$ what will $4\frac{1}{3}$ Yards cost at the same Rate?
2. If $\frac{3}{4}$ of a lb. cost $5s. 6d.$ what will $42\frac{1}{8}lb.$ of the same cost?
3. Suppose I give $14s. 8d.$ for $\frac{7}{9}$ cwt. what must be given for 8 cwt. of the same, at that rate?
4. A Merchant makes an Assurance upon a Ship and Cargo, bound to a certain Port, Value $2700l. 10s.$ and agrees to pay 10 Guineas per Cent. to what comes the Premium or Charges of the Assurance?
5. How much South Sea Stock, at $112\frac{5}{8}l.$ per Cent. will $1270l.$ Purchase?
6. A Mercer bought $4\frac{1}{2}$ Pieces of Silk, each Piece containing $22\frac{3}{4}$ Yards, and was to give $8s. 9d.$ per Yard; I demand the Value of the Whole?
7. If I give $100l. 10s. 6d.$ for 12 Pieces of Holland, at the Rate of $5s. 6\frac{3}{4}d.$ per Ell Flemish; I demand how many Ells English each Piece contained?

42. THE RULE of THREE INVERSE.

IN VULGAR FRACTIONS.

As I observed in the Rule of Three Direct, of their being two Methods of performing it, so likewise in this.

R U L E.

1. Prepare the Fraction as before directed, and then proceed as in Sect. 13, or,
2. Multiply the Denominator of the third Number into the Numerator of the first and second for a new Numerator; then multiply the Numerator of the third Number into the Denominator of the first and second, for a Denominator, which place under the Numerator for an Answer, and find the proper Quantity as before; or invert the last Term, and proceed as in Sect. 39.

† M

EX-

E X A M P L E S.

1. A. lends B. 25 $\frac{1}{2}$ l. for 6 $\frac{1}{2}$ Months; how long ought B. to let A. have 10 $\frac{1}{2}$ l. to requite his Kindness?
2. If 4 Men can do a Piece of Work in 12 $\frac{1}{2}$ Hours, in how many Hours will 12 Men do the same?
3. If the Penny Loaf weighs 12 $\frac{1}{2}$ oz. when the Bushel of Wheat is sold for 5s. what is the Bushel worth, when the Penny Loaf weighs 8 $\frac{1}{2}$ oz.?
4. Suppose A. lends to B. 100 $\frac{2}{3}$ l. for 6 $\frac{1}{2}$ Months, what Sum must B. lend A. for 3 $\frac{1}{6}$ Years to requite him?
5. How many Yards of Cloth at 8s. 6d. per Yard, must be given for 26 $\frac{1}{5}$ Yards, at 5s. 7d. per Yard?

43. The DOUBLE RULE of THREE.

IN VULGAR FRACTIONS.

R U L E.

Prepare the Number as before directed, and then proceed as in (17:)

E X A M P L E S.

1. What Principal, put to Interest, will gain 4l. 15s. in 9 Months, at 6l. per Cent. per Annum?
2. Suppose 12 Students spend 14l. 6s. 8d. in 16 Days, how much will 18 Students spend in 34 Days?
3. If the Carriage of 40 cwt. 30 Miles, cost 16l. 13s. 4d. What Weight may I have carried 80 Miles for 6l. 17s. 6d. at the same Rate?
4. Six Men with their Wives, upon Calculation, found that their Expences for three Months past (allowing 30 Days to one Month) amounted to 26l. 19s. 4d. I demand what Time 14l. 15s. may be spent by 36 Men in the like Proportion?
5. If 30 Men can perform a Piece of Work in eleven Days, how many will accomplish another, four Times as big, in one fifth of the Time?
6. Agreed for the Carriage of 2 $\frac{1}{2}$ Tons of Goods, 3 Miles wanting $\frac{1}{10}$, for $\frac{1}{8}$ of $\frac{3}{5}$ of a Guinea: What was that per cwt. for a Mile?

Q U E S.

T H E

YOUNG ARITHMETICIAN'S

A S S I S T A N T.

P A R T III.

44. DECIMAL FRACTIONS.

A Decimal Fraction, is a Fraction whose Denominator is always Unity or 1, with one or more Cyphers: Thus, an Unit may be imagined to be equally divided into 10 Parts, and each of these into 10 more; so that by a continual Decimal Sub-division, the Unit may be supposed to be divided into 10, 100, 1000, and so on without End, all being equal Parts, called tenth, hundredth, thousandth Parts of an Unit or 1.

In Decimal Fractions, the Figures of the Numerator are only expressed, the Denominator being omitted, because it is always known to consist of an Unit with so many Cyphers as there are Places in the Numerator.

A Decimal Fraction is distinguished from an Integer with a Point or Comma prefixed, thus, ,5 which stands for $\frac{5}{10}$; or $\frac{1}{2}$; ,75 for $\frac{75}{100}$, or $\frac{3}{4}$; ,2752 for $\frac{2752}{10000}$; and 12,005 for $12\frac{5}{1000}$, or $12\frac{1}{200}$ &c.

Cyphers at the right Hand of a Decimal Fraction alter not its Value: for ,5 or ,50 or ,5000 is each of them the same Value, and are equal to $\frac{5}{10}$ or $\frac{1}{2}$; but Cyphers at the Left Hand, in a Decimal Fraction, decrease the Value in a tenfold Proportion, for ,05 is $\frac{5}{100}$, also, ,0005 is $\frac{5}{10000}$, &c. all of which will plainly appear by the following

† M 2

T A B L E.

Addition of Decimals.

T A B L E.

7	6	5	4	3	2	1	2	3	4	5	6	7 &c.
Millions.	C. of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	Parts of Ten.	Parts of one Hundred.	Parts of one Thousand.	Parts of ten Thousand.	Parts of one C. Thousand.	Parts of a Million.

By the above Table it also plainly appears, that as whole Numbers increase towards the Left Hand by a ten-fold Proportion, so Decimal Parts decrease towards the Right Hand by the same Proportion.

A finite Decimal is that which ends at a certain Number of Places; but an infinite, is that which no where ends.

A circulating or recurring Decimal, is that wherein one or more Figures are continually repeated.

Thus 64,766666, &c. or 64,76, is called a single circulate or recurring Decimal.

And 147,642642, &c. or 147,642, is called a compound recurring Decimal.

Note. In all Operations, if the Result consists of several Nines, reject them, and make the next superior Place a Unity more. Thus, for 17,1999 write 17,2; and for 12,99, write 13, &c.

45. ADDITION of DECIMALS.

Addition and Subtraction in Decima's, are performed after the same Manner as Sect. 2, 3, of whole Numbers. Care being taken, that like Parts be placed under one another, and from their Sum or Difference cut off so many Decimal Parts as there are the most in any of the given Numbers.

E X A M P L E S.

1. What is the Sum of ,0476, 21,476, ,0067, ,64, 17,6, and ,20764?

1. Add

2. Add .427, 64,075, 27,6421, 10,8, .0074, and 104,046842 together.
3. What is the Sum of .274, .076, .64762, .0706, .47, .007, and 968,42.

46. SUBTRACTION of DECIMALS.

E X A M P L E S.

1. What is the Difference between 176 and 10,764?
2. From 647, take .00746.
3. What is the Difference between 74,6407, and 69,5?

47. MULTIPLICATION of DECIMALS.

Multiplication in Decimals is also performed as in whole Numbers, no Regard being had to the Decimals as such, till the Product is obtained, then observe the following

R U L E.

1. Strike off so many Figures from the right Hand of the product as there are Decimal Places in the Multiplier and Multiplicand.
2. But if there are not so many Figures in the Product, supply the Deficiency by prefixing Cyphers to the left Hand to make them equal.
3. If the Number is to be multiplied by 10, 1000, &c. remove the separating Point in the Multiplicand so many Places to towards the right Hand, as there are Cyphers in the Multiplier.

E X A M P L E S.

- | | |
|----------------------------|---------------------------|
| 1. Multiply 17504, by 76. | 2. Mul. 27,42, by 3,56. |
| 3. Mul. 8,04704, by .2575. | 4. Mul. 5745, by .0675. |
| 5. Mul. .4, by .2. | 6. Mul. .047 by .246. |
| 7. Mul. .0476 by .02078. | 8. Mul. .47 by .0008. |
| 9. Mul .1076 by 1000. | 10. Mul. .42768 by 10000. |

48. DIVISION of DECIMALS.

In Division of Decimals, the Work is likewise performed as in Whole Numbers; the only Difficulty is in valuing the Quotient, which will be very easy by observing either of the following general

R U L E S.

1. The first Figure in the Quotient is always of the same Value with that Figure of the Dividend, which answers or stands over the Place of Units in the Divisor.

2. The Quotient must always have so many Decimal Places, as the Dividend has more than the Divisor.

E X A M P L E S.

1. Divide 1735.5 by 6.5.
2. Divide ,8332 by ,0084.
3. Divide 186.9 by 7.476.
4. Divide 6 by ,008.
5. Div. 246,1476 by 604,25.
6. Divide 7,268401 by 119.
7. Divide 6,7258 by 647.
8. Divide ,0008136 by 678.
9. Divide 487,67 by 1000.
10. Divide ,4746 by 10000.

49. REDUCTION of DECIMALS.

1. To reduce a Vu'gar Fraction to a Decimal.

R U L E.

Add Cyphers to the Numerator, and Divide by the Denominator, the Quotient will be the Decimal Fraction required.

E X A M P L E S.

1. Reduce $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, to Decimals.
2. Reduce $\frac{5}{24}$ to a Decimal.
3. Reduce $\frac{1}{12}$ of $\frac{1}{4}$ to a Decimal.
4. Reduce $\frac{4}{7}$ to a Decimal.
5. Reduce $\frac{2}{3}$ to a Decimal.
6. Reduce $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{7}{8}$ to a Decimal.
7. Reduce $\frac{1}{4}$ of $\frac{5}{12}$ to a Decimal.

2. To reduce Coins, Weights, Measures, &c. into Decimals.

R U L E.

R U L E I.

Reduce the given Money, Weights, &c. into the lowest Denomination or name mentioned, for a Dividend; then reduce the Integer into the same Denomination for a Divisor, the Result will be the Decimal required.

R U L E II.

Write the given Denomination or Parts orderly under each other, the inferior or least Parts being uppermost; let these be the Dividends. Against each Part on the Left Hand, write the Number thereof contained in one of its superior; let these be Divisors. Then beginning with the lowest Denomination with Cyphers added (making a Dot between the Cyphers and the Figure) and divide, writing the Quotient of each Divisor as Decimal Parts on the Right Hand of the Dividend next below it: and let this mixt Number be divided by its Divisor, and so on, till all be finished, and the last Quotient will be the Decimal required.

E X A M P L E S.

1. Reduce 17s. 6 $\frac{3}{4}$ d. to the Decimal of a Pound.
2. Reduce 6s. 9d. to the Decimal of a £.
3. Reduce 9s. to the Decimal of a Guinea.
4. Reduce 14s. 6 $\frac{1}{2}$ d. to the Decimal of a Moidore.
5. Reduce 18s. 4 $\frac{1}{2}$ d. to the Decimal of a £.
6. Reduce $\frac{3}{4}$ of a Penny to the Decimal of a £.
7. Reduce 11 dwts. to the Decimal of a lb. Troy.
8. Reduce 10 Drams to the Decimal of a lb. Avoirdupoise.
9. Reduce 3 qrs. 14 lb. to the Decimal of a cwt.
10. Reduce 6 Inches to the Decimal of a Yard.
11. Reduce 6 Furlongs to the Decimal of a League.
12. Reduce 18 gall. 2 qts. of Wine to the Decimal of a Tun.
13. Reduce 3 qrs. 1 pt. of Ale to the Decimal of a Barrel.
14. Reduce 8 Perches to the Decimal of an Acre.
15. Reduce 4 Bushels 2 Pecks to the Decimal of a Chaldron.
16. Reduce 12 Minutes to the Decimal of an Hour.
17. Reduce 12 Days to the Decimal of a Year (Julian).

C A S E

3. To find the Value of any Decimal Fraction, in Money, Weight, Measure, &c.

R U L E.

Multiply the Decimal by the Number of Parts of the next inferior Denomination, cutting off so many Places for Decimals to the Right Hand, as your given Decimal consists of, and those on the Left will be Integers; then multiply the remaining Decimals by the next inferior Denomination, and cut off for Decimals as before; thus proceed till you have brought it into the least Parts of the Integer.

E X A M P L E S.

1. What is the Value of ,878125 of a Pound Sterling?
2. What is the Value of ,3375 of a £.
3. What is the Value of ,45 of a Guinea?
4. What is the Value of ,72708 of a Moidore?
5. What is the Value of ,00243 of a lb. Troy?
6. What is the Value of ,3375 of a Ton?
7. What is the Value of ,0396 of a lb. Avoirdupoise?
8. What is the Value of ,875 of a cwt.
9. What is the Value of ,16669 of a Yard?
10. What is the Value of ,259 of a League?
11. What is the Value of ,29365 of a hhd. of Wine?
12. What is the Value of ,875 of a Barrel of Ale?
13. What is the Value of ,05 of an Acre?
14. What is the Value of ,125 of a Chaldron of Coals?
15. What is the Value of ,4765 of a Day?

50. EXTRACTION of the SQUARE ROOT.

Extracting the Square Root, is to find out such a Number as being multiplied into itself, the Product will be equal to the given Number.

As the Square Root of 81 is 9, consequently $9 \times 9 = 81$ the given Number.

Roots.	1 2 3 4 5 6 7 8 9
Squares.	1 4 9 16 25 36 49 64 81

To

To extract the Square Root of any Number, observe the following

R U L E S.

1. Point the given Number or Resolvend into Periods of two Figures each, beginning at the Units Place.
2. Find by the Table the greatest Square Number that is contained in the first Period towards the Left Hand, placing the Square Number under the first Period, and the Root thereof in the Quotient (as in Division), subtract that Square out of the said Period, and to the Remainder bring down the next Period for a Dividend.
3. Double the Quo.ient or Root, and Place it for a Divisor, seek how often the Divisor is contained in the Dividend (reserving always the Unit's Place), and put the Answer in the Quotient, and also on the Right Hand of the Divisor: Then multiply the Divisor by the last Figure put in the Quo.ient (as in common Division), the Product subtract from the Dividend, and to the Remainder bring down the next Period, which proceed with as before.

- Note 1.** But if it happens that the given Resolvend is not a perfect Square, Cube, &c. then something will remain after Extraction hath been made throughout a'l the Points: When this is the Case, you must annex Cyphers according as the proposed Power requires, viz. by Pairs or twos in the Square; threes in the Cube, &c. and the Operation continued as before.
2. If the given Resolvend consists of a Whole Number and Decimals together, make the Number of Decimals even by adding Cyphers to them.

E X A M P L E S.

1. Let it be required to extract the Square Root of 74770609.
2. What is the Square Root of 60516?
3. What is the Square Root of 7658?
4. What is the Square Root of 39342864?
5. What is the Square Root of 8209667940,529?
6. What is the Square Root of ,000729?
7. What is the Square Root of 2?
8. What is the Square Root of 2,2710957?
9. What is the Square Root of 35,00000625?

To extract the SQUARE ROOT of VULGAR FRACTIONS.

R U L E.

Reduce the Fraction or Fractional Parts to its lowest Terms, and if it be a mixed Number, to an improper Fraction; then extract the Square Root of the Numerator for a new Numerator, and the Square Root of the Denominator for a new Denominator.

E X A M P L E S.

1. What is the Square Root of $\frac{25}{81}$?
2. What is the Square Root of $\frac{225}{324}$?
3. What is the Square Root of $10\frac{1}{4}$?
4. What is the Square Root of $27\frac{9}{16}$?

S U R D S.

To extract the Square Roots of Vulgar Fractions, when they be Surds, i. e. a Number where a Root can never be exactly found.

R U L E.

Reduce the Fraction or Fractional Part to its lowest Terms, then reduce it to a Decimal, and annex that Decimal to the Whole Number (if any) and extract the Square Root therefrom.

E X A M P L E S.

5. What is the Square Root of $8\frac{1}{2}$?
6. What is the Square Root of $\frac{127}{676}$?
7. What is the Square Root of $76\frac{1}{4}$?

51. The USE of the SQUARE ROOT.

C A S E I.

To find a mean Proportion between any two given Numbers.

R U L E.

R U L E.

Multiply the two given Numbers together, and extract the Square Root of the Product, which Roots will be a mean Proportional sought.

E X A M P L E S.

1. What is the mean Proportional between 4 and 9?
2. What is the mean Proportional between 16 and 36?

C A S E II.

To find the Side of a Square equal in Area to any given Superficies.

R U L E.

Extract the Square Root of the given Superficies, which Root will be the Side of the Square sought.

E X A M P L E S.

3. If the Area of a given Circle is 4276,5, I demand the Side of a Square, whose superficial Content shall be equal thereto?
4. Suppose I have an elliptical or irregular Fish-Pond, containing in Surface 9 Acres, 2 Roods, 15 Perches, and would have a square one of the same Content; I desire you'd tell how many Yards each Side must be?
5. If the Content of a given Circle be 160, what is the Side of a Square equal thereto?

C A S E III.

Having the Area of a Circle, to find the Diameter.

R U L E.

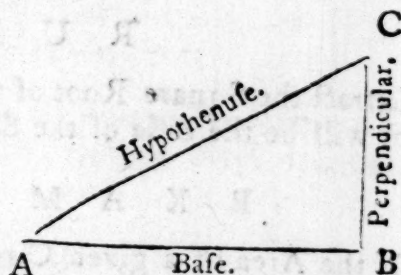
As 355 : 452 :: or, as 1 : 1,273239 :: so is the Area to the Square of the Diameter : or multiply the Square Root of the Area by 1,12837, and the Product will be the Answer. (See Problem VI. in Mensuration.)

E X A M P L E S.

6. Required the Diameter of a Circle that will comprehend within its Circumference, the Quantity of an Acre of Land.
7. In the Midst of a Meadow well stored with Grass,
I took just two Acres to tether my Horse;
How long must the Cord be, that feeding all round,
He mayn't graze less or more than these two Acres of Ground?

C A S E IV.

Any two Sides of a right-angled Triangle, ABC , being given, to find the remaining Side.



1. The Base and Perpendicular being given to find the Hypothenufe.

R U L E.

Square each Side, add the Squares together, and the Square Root of this Sum gives the Hypothenufe required.

2. If the Hypothenufe and one Side be given, to find the other side.

R U L E.

From the Square of the Hypothenufe, subtract the Square of the given Side, the Square Root of the Remainder gives the Side required.

E X A M P L E S.

3. At Matlock, near the Peak in Derbyshire, where are many surprising Curiosities in Nature, is a Rock by the Side of the River Derwent, rising perpendicular

to a wonderful Height, which being inaccessible, I endeavoured to measure, and found by a mathematical Method, that the Distance between the Place of Observation and the Foot of the Rock to be $55\frac{1}{2}$ Yards, and from the Top of the Rock to the said Place to be $140\frac{1}{2}$ Yards (nearly), required the Height of this stupendous Work?

9. A Ladder 40 Feet long may be so planted that it shall reach a Window 33 Feet from the Ground on one Side the Street; and, without moving it at the Foot, will do the same by a Window 21 Feet high on the other Side; the Breadth of the Street is required?

10. A Line 27 Yards long, will exactly reach from the Top of a Fort, on the opposite Bank of a River, known to be 23 Yards broad: The Height of the Wall is required?

11. Suppose a Light-House built on the Top of a Rock, the Distance between the Place of Observation and that Part of the Rock level with the Eye, and directly under the Building, is given 310 Fathoms; the Distance from the Top of the Rock to the Place of Observation is 423 Fathoms; and from the Top of the Building 425: The Height of the Edifice is required?

12. Two Ships set sail from the same Port, one of them sails due East 50 Leagues, the other due North 84: How far are they asunder?

52. The EXTRACTION of the CUBE ROOT.

To extract the Cube Root, is to find out a Number, which being multiplied into itself, and then again into the Product, produceth the given Number.

As the Cube Root of 729 is 9, consequently $9 \times 9 \times 9 = 729$ the given Number, and so of others, as in the following Table.

Roots.	1	2	3	4	5	6	7	8	9
Cubes.	1	8	27	64	125	216	343	512	729

R U L E.

1. Make a Point over every third Figure given, beginning at the Unit's Place, seek the greatest Cube to the first Point

† N

Point

Point on the Left Hand (by the Table) whose Root, place in the Quotient, then subtract its Cube from the Period, and to the Remainder (if any) bring down the three Figures, or your next Period, and call it your Dividend.

2. Find a Divisor by calling your Quotient Figure, with a Cypher joined to it, r ; then three Times the Square of r will be your Divisor; seek how often it is contained in the Dividend, and put the Answer in the Quotient as in Division, only with this Difference: call the said Quotient Figure last put up e , and multiply your Divisor by it, and place the Produce underneath the Dividend, then multiply the Square of e , by three Times r , and place it also under the Dividend; lastly, cube the Figure you called e , and place it under the Dividend: then add the three Products together, gives the Subtrahend, which subtract from your last Dividend, and to the Remainder, bring down the next Period, and proceed as before.

E X A M P L E S.

1. What is the Cube Root of 21024576?
2. Extract the Cube Root of 92398647.
3. What is the Cube Root of 2716243264?
4. What is the Cube Root of 91?
5. What is the Cube Root of 67527834239?
6. Extract the Cube Root out of 4764.75.
7. The Solidity of a Cube is 36155,027576 Inches, what is the Side of that Cube?
8. What is the Side of that Cube, which contains 67667,921875 solid Inches?
9. What is the Cube Root of 219365329?
10. What is the Cube Root of 3105926,917?
11. What is the Cube Root of ,000421875?
12. What is the Side of a Cube, whose Solidity is 28022810,390625?

To extract the CUBE ROOT of a VULGAR FRACTION.

Note. The same Rules, with regard to Fractions, which are given in Page 175, must be observed here, only extracting the Cube Root instead of the Square; that is, reduce the Fractions to their lowest Terms; if it be a mixed Number, to an improper Fraction; and if a Surd, to a Decimal.

E X A M P L E S.

1. What is the Cube Root of $1\frac{24}{80}$?
2. What is the Root of $1\frac{2}{8}$?
3. What is the Cube Root of $5\frac{104}{25}$?
4. What is the Cube Root of $405\frac{28}{25}$?

S U R D S.

5. What is the Cube Root of $5\frac{3}{5}$?
6. What is the Cube Root of $7\frac{1}{7}$?

53. The USE of the CUBE ROOT.

C A S E I.

To find the Side of a Cube that shall be equal in Solidity to any given Solid, as a Globe, Cylinder, Prism, Cone, &c.

R U L E.

Extract the Cube Root of the solid Content of the given Body, which Root will be the Side of the Cube required.

E X A M P L E.

1. There is a Stone of a cubic Form, which contains 21925 solid Feet; what is the superficial Content of one of its Sides?

C A S E II.

Having the Dimensions of any solid Body, to find the Dimensions of another similar Solid, that shall be any Number of Times greater or less than the Solid given.

R U L E.

Multiply the Cube of each Side by the Difference between the Solid given and that required, if greater (or divide by the Difference if less) than the Solid given; then extract the Cube Root of each Product or Quotient, which will give the Dimensions of the Solid required.

E X A M P L E S.

2. Suppose the Length of a Ship's Keel to be 125 Feet, the Breadth of the Midship Beam 25 Feet, and the Depth of the Hold 15 Feet; I demand the Dimensions of another Ship of the same Form, that shall carry three Times the Burthen?
3. Again, I demand the Dimension of another Ship of the same Form, that shall only be Half the Burthen of that whose Dimensions are given as above?

C A S E III.

Having the Dimensions and Capacity of a Solid, to find the Dimensions of a similar Solid of a different Capacity.

R U L E.

Like Solids are in triplicate Portion to their homologous Sides, therefore it will be as the Cube of a Dimension : is to its given Weight : : so is the Cube of any like Dimension : to the Weight sought.

E X A M P L E S.

4. If a Ship of 300 Tons Burthen, be 75 Feet long in the Keel, I demand the Burthen of another Ship, whose Keel is 100 Feet long.
5. Suppose a Ball of 4 Inches Diameter weighs 18 lb. I demand the Diameter of another that weighs 114 lb.
6. If a Brass Saker, whose Diameter is 11,5 Inches, weighs 1000 lb, what will another Piece of Ordnance (of the same Metal and Shape) weigh, whose Diameter is 20,83 Inches?

C A S E IV.

To find two mean Proportionals between two given Numbers.

R U L E.

Divide the greater Extreme by the less, and the Cube Root of the Quotient multiplied by the less Extreme gives the lesser Mean; multiply the said Cube Root by the lesser Mean, and the Product will be the greater mean Proportional.

E X-

E X A M P L E S.

7. What are the two mean Proportionals between 7 and 189?
8. Find two mean Proportionals between 4 and 256.

54. The SINGLE RULE of THREE in DECIMALS.

R U L E.

Reduce the Fractional Parts into Decimals of the highest Name mentioned; then state the Question, and proceed as in Sect. 12, and 13.

E X A M P L E S.

1. Suppose I give 6s. 3d. for $4\frac{3}{4}$ Yards of Cloth; what will $48\frac{1}{2}$ yds. of the same come to at that Rate?
2. If $2\frac{1}{2}$ lb. of Tea cost 1l. 5s. what will $14\frac{1}{4}$ lb. come to at the same Rate?
3. If 1 lb. of Sugar cost 11 $\frac{1}{2}$ d. what will 4 hhds. each weighing Net 4 cwt. 2 qrs. 14 lb. cost at the same Rate?
4. A Grocer buys 4 Chests of Tea, each weighing Net 2 cwt. 3 qrs. 14 lb. for 906l. 10s. at what Rate did he give per lb.
5. How far will a Person be able to travel in 9 Days, 8 Hours, at the Rate of 12 Miles every 4 Hours, allowing 12 Hours to the Day.
6. An Oilman bought 4 Tuns $201\frac{1}{2}$ Gallons of Florence Oil for 249l. 16s. 6d. but by Misfortune it chanced to leak out $24\frac{1}{2}$ Gallons: I desire to know at what he must sell the Remainder per Gallon, to be no Loser?
7. Goliath is said to have been 6 Cubits and a Half, or a Span, high; this answers to 10 Feet 4 Inches and $\frac{7}{12}$: Pray what was the Length of the Cubit in British Measure?

55. The DOUBLE RULE of THREE in DECIMALS.

Reduce the fractional Parts to Decimals, and then proceed as in Sect. 14.

E X A M P L E S.

1. If 1*l.* 2*s.* worth of Wine will suffice a Club of 12 Persons, when the Wine is sold at the Rate of 25*l.* 4*s.* per hhd. how many Persons will 1*l.* 12*s.* worth serve, when the Wine is sold after the Rate of 18 Guineas per hhd.?
2. If 6*lb.* of Pepper be worth 13*lb.* of Ginger, and 19*lb.* of this be worth 4½*lb.* of Cloves, and 10*lb.* be equivalent to 63*lb.* of Sugar at 5*d.* per *lb.* what is the Value of 1 cwt. of Pepper?
3. What Money, at 3½ per Cent. will clear 38*l.* 2*s.* 6*d.* in a Year and a Quarter's Time?

Of Simple Interest, Annuities or Pensions, &c.

56. 1. SIMPLE INTEREST.

Here are five Letters to be observed, viz.

P=any Principal or Sum put to Interest.

I=the Interest.

T=the Time of the Principal's Continuance at Interest.

A=the Amount, or Principal and its Interest.

R=the Ratio, or Rate per Cent. per Annum.

Note. The Ratio, is the Simple Interest of 1*l.* for one Year, at any given Rate; and is thus found,

1. 1. 1. 1.

Viz. 100 : 5 :: 1 : ,05 the Ratio at 5 per Cent. per Ann.

Or, 100 : 6 :: 1 : ,06 the Ratio at 6 per Cent. per Ann.
&c.

And in this Manner the Ratios in the following Table are found.

T A B L E.

3 = ,03	4½ = ,045
3½ = ,035	5 = ,050
4 = ,04	5½ = ,055

1. When the Principal, Time, and Rate per Cent. are given, to find the Interest.

RULE.

Simple Interest.

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R U L E.

Multiply the Principal, Rate, and Time continually into one another, the Product is the Interest sought.

Or, if p = the Principal, t = the Time, r = the Rate, and I = the Interest, then the Theorem will be as follows.

THEOREM I. $p \times r = I.$

E X A M P L E S.

1. What is the Interest of 26*l.* 17*s.* 6*d.* for $5\frac{1}{2}$ Years at $4\frac{1}{2}$ per Cent. per Annum?
2. What is the Interest of 50*l.* from May the 12th, 1784. to November the 24th, 1789, at $3\frac{1}{2}$ per Cent. per Ann?
2. When the INTEREST required is for DAYS only.

R U L E.

Multiply the Interest of *1l.* for one Day, at the given Rate, by the Principal and Number of Days, it will give the Answer.

The Interest of *1l.* for one Day, is thus found,

d. *l.* *d.* *l.*

Viz. As 365 : ,05 :: 1 : ,0001369863, &c.

Or 365 : ,035 :: 1 : ,00009589041, &c.

T A B L E.

per Cent.	Decimals.
3	=,00008219178
$3\frac{1}{2}$	=,00009589041
4	=,00010958904
$4\frac{1}{2}$	=,00012328767
5	=,0001369863

E X A M P L E S.

3. What is the Interest of 370*l.* 10*s.* for 220 Days at $4\frac{1}{2}$ per Cent. per Annum?
4. What is the Interest of 600*l.* from the 1st of July, 1784, to the 24th of February following, at 6 per Cent.

When

When the Principal Term, and Rate per Cent. are given, to find the Amount.

R U L E.

Find the Interest by Theorem 1, which, added to the Principal, will give the Amount.

Thus, THEOREM 2. $ptr + p = A.$

E X A M P L E S.

5. What will 284*l.* 10*s.* amount to in 7 Years, at $3\frac{1}{2}$ per Cent. per Annum?
6. What will 67*z.* 5*s.* amount to in $5\frac{1}{2}$ Years, at $4\frac{1}{2}$ per Cent. per Annum?
7. What will 500*l.* amount to in 6 Years 120 Days, at $4\frac{1}{2}$ per Cent. per Annum?

When the Rate, Time, and Interest are given, to find the Principal.

R U L E.

Divide the Interest by the Product of Rate and Time, the Quote is the Principal.

Thus, THEOREM 3. $\frac{I}{tr} = p.$

E X A M P L E S.

8. I demand, what Principal, being put to Interest for 3 Years, will gain 69*l.* 13*s.* 6*d.* at 5 per Cent. per Ann.?
9. I demand, what Principal, being put to Interest for $5\frac{1}{2}$ Years, will gain 64*l.* 7*s.* at $4\frac{1}{2}$ per Cent. per Ann.?
10. I demand what Principal, being put to Interest for 4 Years, at 4 per Cent. will gain 67*l.* 15*s.* 9*d.*

When the Amount, Rate, and Time are given, to find the Principal.

R U L E.

Add 1 to the Product of the Rate and Time, and by that Sum divide the Amount, the Quote is the Principal.

Thus, THEOREM 4. $\frac{a}{tr + 1} = p.$

E X.

E X A M P L E S.

11. What Principal, being put to Interest, will amount to 3; L. 4s. $\frac{1}{2}$ d. in 7 Years, at $3\frac{1}{2}$ per Cent. per Annum?
12. What Principal, being put to Interest, will amount to 500l. 9s. $3\frac{1}{4}$ d. in 6 Years, 5 Months, at 5 per Cent. per Annum?
13. What Principal, being put to Interest for 7 Years, 220 Days, at $4\frac{1}{2}$ per Cent. per Annum, will amount to 100l.

When the Principal, Interest, and Rate are given, to find the Time.

R U L E.

Divide the Interest by the Product of the Principal and Rate, the Quote is the Time.

Thus, THEOREM 5. $\frac{I}{pr} = t.$

E X A M P L E S.

14. In what Time will 464l. 10s. gain 69l. 13s. 6d. at 5 per Cent. per Annum?
15. In what Time will 260l. gain 64l. 7s. at $4\frac{1}{2}$ per Cent. per Annum?
16. In what Time will 500l. gain 130l. 9s. 7d. at $6\frac{1}{2}$ per Cent. per Annum?

When the Principal, Interest, and Rate are given, to find the Time.

R U L E.

Divide the Amount less the Principal, by the Product of the Principal and Rate, the Quote is the Time.

Thus, THEOREM 6 $\frac{a-p}{pr} = t.$

E X A M P L E S.

17. In what Time will 284l. 10s. amount to 354l. 4s. $\frac{1}{2}$ d. at $3\frac{1}{2}$ per Cent. per Annum?

18. In

18. In what Time will 672*l* 5*s*. amount to 847*l*. 17*s*. 6*d*.
at 4½ per Cent. per Annum?
19. In what Time will 378*l*. 18*s*. amount to 500*l*. 9*s*. 3½*d*.
at 5 per Cent. per Annum?

When the Principal, Interest, and Time are given, to find the Rate per Cent.

R U L E.

Divide the Interest by the Product of the Principal and Time, the Quote is the Rate.

THEOREM 7. Thus $\frac{I}{pt} = r.$

E X A M P L E S.

20. At what Rate per Cent. will 464*l*. 10*s*. gain 69*l*. 13*s*. 6*d* in 3 Years?
21. At what Rate per Cent. will 260*l*. gain 64*l*. 7*s*. in 5½ Years?
22. At what Rate per Cent. will 560*l*. 12*s*. 8½*d*. gain 2*l*. 5*s*. 4*d*. in 7 Years?

When the Principal, Amount, and Time are given, to find the Rate.

R U L E.

Take the Difference between the Amount and Principal, and divide it by the Product of the Principal and Time, the Quote is the Rate.

Thus, THEOREM 8. $\frac{a-p}{pt} = r.$

E X A M P L E S.

23. At what Rate per Cent. will 284*l*. 10*s*. amount to 354*l*. 4*s*. ½*d*. in 7 Years?
24. At what Rate per Cent. will 378*l*. 18*s*. amount to 500*l*. 9*s*. ¾*d*. in 6 Years?
25. At what Rate per Cent. will 672*l* 5*s*. amount to 847*l*. 17*s*. 6*d*. in 5½ Years?

57. OF ANNUITIES, PENSIONS, &c. in ARREARS, At SIMPLE INTEREST.

An Annuity is a yearly Income arising from Money, &c. and is either paid for a Term of Years, or upon a Life.

Annuities or Pensions are said to be in Arrears, when they are payable or due either Yearly, Half-Yearly, or Quarterly, and are unpaid for any Number of Payments.

Here U. represents the Annuity, Pension, or yearly Rent, A, T, R, as before,

When U, R, T, are given, to find A.

$$\text{THEOREM 9. } \frac{tu - tu}{2} \times r : + tu = A.$$

When the Annuity, &c. is to be paid Half-Yearly, or Quarterly, then for Half-Yearly Payments, take Half the Ratio, Half the Annuity, &c. and twice the Number of Years; and for Quarterly Payments take a fourth Part of the Ratio, a fourth Part of the Annuity, and four Times the Number of Years, which work with as per Theorem.

E X A M P L E S.

26. If 250*l.* yearly Rent, Pension, &c. be forborn or unpaid 6 Years, what will it amount to in that Time, at 3 per Cent. for each Payment as it becomes due?
27. If a Salary of 250*l.* payable every Half-Year, remain unpaid for 6 Years, what would it amount to in that Time, at 3 per Cent. per Annum?
28. If a Salary of 250*l.* payable every Quarter, was left unpaid for 6 Years, what would it amount to in that Time, at 3 per Cent. per Annum?

When A, R, and T, are given, to find U.

$$\text{THEOREM 10. } \frac{2a}{tr - tr + 2t} = U.$$

When

When the Payments are Half-Yearly, take $4a$; if Quarterly, $8a$; and proceed with the Ratio and Time as before.

E X A M P L E S.

29. If a Salary payable Yearly amounts to $1612\frac{1}{2}$ 10s. in 6 Years, at 3 per Cent. what is the Salary?
30. The Amount of a Salary payable Half-Yearly for 6 Years, at 3 per Cent. is $1623\frac{1}{2}$ 15s. what is the Salary?
31. If the Amount of an Annuity, payable Quarterly, be $1629\frac{1}{2}$ 7s. 6d. for 6 Years, at 3 per Cent. what is the Annuity?

When U , A , and T , are given, to find R .

$$\text{THEOREM 11. } \frac{2a - 2ut}{ut - ut} = R.$$

When the Payments are Half-Yearly, take $4a - 4ut$ for a Dividend: if Quarterly take $8a - 8ut$, and proceed with the Annuity and Time as is mentioned in Theorem 9.

E X A M P L E S.

32. If a Salary of 200l. per Annum, amounts to $1612\frac{1}{2}$ 10s. in 6 Years, what is the Rate per Cent?
33. If a Salary of 250l. per Annum, payable Half-Yearly amounts to $1623\frac{1}{2}$ in 6 Years, what is the Rate per Cent?
34. Suppose a Pension of 250l. per Annum, payable Quarterly, amounts to $1629\frac{1}{2}$ 7s. 6d. in 6 Years, what is the Rate per Cent.?

When U , A , and R , are given, to find T .

$$\text{THEOREM 12. First } \frac{2}{r} - 1 = X. \text{ Then } \sqrt{\frac{2a}{ur} + \frac{xx}{4}} - \frac{x}{2} = T$$

When the Payments are Half-Yearly or Quarterly, proceed with the Ratio and Annuity as mentioned before, and T will be equal to those Half-Yearly or Quarterly Payments.

E X A M P L E S.

35. In what Time will a Salary of 250*l.* per Annum amount to 1612*l.* 10*s.* at 3 per Cent.?
36. If an Annuity of 250*l.* per Annum payable Half-Yearly amounts to 1623*l.* 15*s.* at 3 per Cent. what Time was the Payments forborn?
37. If an Annuity of 250*l.* per Annum, payable Quarterly, amounts to 1629*l.* 7*s.* 6*d.* at 3 per Cent. what was the Time of Forbearance?

58. PRESENT WORTH of ANNUITIES, &c.

Here P, represents the present Worth; U, T, and R, as before.

When U, T, and R, are given, to find P.

$$\text{THEOREM 13. } \frac{tr - tr + 2t}{2tr + 2} : \times U = P.$$

The same is to be observed here for Half-Yearly and Quarterly Payments, as before mentioned.

E X A M P L E S.

38. What is the present Worth of 250*l.* per Annum, to continue 6 Years, worth in ready Money to continue 6 Years?
39. What is a Pension of 250*l.* per Annum worth in ready Money, payable Half-Yearly, at 3 per Cent. for 6 Years?
40. What is the present Worth of 250*l.* payable Quarterly, for 6 Years, at 3 per Cent.?

When P, T, and R, are given, to find U.

$$\text{THEOREM 14. } \frac{tr + 1}{tr - tr + 2t} : \times 2p = U.$$

When the Payments are Half-Yearly, multiply by 4 *p*; for Quarterly, by 8 *p*; and proceed with *t* and *r* as before directed.

E X A M P L E S.

41. What Annuity is that, which for 6 Years Continuance produces 1366*l.* 10*s.* 6*d.* present Worth, at 3 per Cent.?
42. There is an Annuity, payable Half-Yearly, for 6 Years to come; what is the yearly Income, when the present Worth, at 3 per Cent. is 1376*l.* 5*s.*?
43. There is an Annuity payable Quarterly for 6 Years to come; what is the yearly Income, when the present Worth is 1380*l.* 17*s.* 6*d.* at 3 per Cent.?

When U, P, and T, are given, to find R.

$$\text{THEOREM 15. } \frac{ut - p \times 2}{2pt + ut - uit} = R.$$

When the Payments are Half-Yearly, or Quarterly, proceed with the Annuity and Time as before directed, and the Quotient will be the Answer accordingly; i. e. if for Half Yearly, the Quotient will be Half the Ratio, and if for Quarterly, a fourth Part of the Ratio.

E X A M P L E S.

44. At what Rate per Cent. will an Annuity of 250*l.* per Annum, to continue 6 Years, produce the present Worth of 1366*l.* 10*s.* 6*d.*?
45. If an Annuity of 250*l.* per Annum, payable Half-Yearly, having 6 Years to come, is sold for 1376*l.* 5*s.* what is the Rate per Cent.?
46. At what Rate per Cent. will an Annuity of 250*l.* per Annum, payable Quarterly, to continue 6 Years, produce 1380*l.* 17*s.* 6*d.* for the present Worth.

When U, P, and R, are given, to find T.

$$\text{THEOREM 16. First } \frac{2 \ 2p}{r \ u} - 1 = x.$$

$$\text{Then } \sqrt{\frac{2p}{ur} + \frac{xx}{4} - \frac{x}{2}} = t.$$

When

When the Payments are Half-Yearly or Quarterly, proceed with the Annuity and Ratio as before directed, and the Quotient will be the Number of Payments.

E X A M P L E S.

47. If an Annuity of 25*l.* per Annum produces 1366*l.* 10*s.* 6*d.* for the present Worth at 3 per Cent. what is the Time of its Continuance?
48. An Annuity of 25*l.* per Annum, payable Half-Yearly, is sold for 1376*l.* 5*s.* at 3 per Cent. I desire to know the Number of Payments and Time to come?
49. Suppose a Lease of a House of 25*l.* per Annum, payable Quarterly, is sold for 1380*l.* 17*s.* 6*d.* at 3 per Cent. I demand the Number of Payments and Time to come?

59. ANNUITIES, &c. taken in REVERSION.

C A S E I.

To find the present Worth of an Annuity taken in Reversion.

R U L E S.

1. Find the present Worth of the yearly Sum at the given Rate, and for the Time of its Continuance.
2. Change P into A, and find what Principal being put to Interest will Amount to A at the same Rate, and for the Time to come, before the Annuity, &c. commences.

THEOREM 17.

$$1. \text{ Thus } \frac{tir - tr + 2t}{2tr + 2} \times U = P.$$

$$2. \text{ Thus } \frac{a}{tr + 1} = P.$$

E X A M P L E S.

50. What is the present Worth of 25*l.* per Annum, to continue 6 Years, but not to commence until the End of 4 Years, allowing 3 per Cent. to the Purchaser?
51. What is the present Worth of a Lease of 80*l.* per Annum,

num, to continue $7\frac{1}{2}$ Years, but not to commence until the End of 5 Years, allowing $4\frac{1}{2}$ per Cent. to the Purchaser?

52. There is a Legacy of 40*l.* per Annum, for 10 Years, left to a Person of 14 Years of Age; the Time of Payment is not to commence till the said Person's Age be 21; but he wanting a Sum of Money, is minded to sell the same at 5 per Cent. I demand the present Worth?

To find the yearly Income of an Annuity, &c. in Reversion.

R U L E S.

- | | |
|--|--|
| <p>1. Find the Amount of the present Worth at the given Rate, and for the Time of its Continuance.</p> <p>2. Change A into P, and find what Annuity being sold will produce P at the same Rate, and for the Time of its Continuance.</p> | <p>Thus Theorem 18. $ptr + p = A$.</p>
<p>Thus $\frac{tr + 1}{tr - tr + 2t} \times 2p = U$.</p> |
|--|--|

E X A M P L E S.

53. A person having an Annuity left him for 6 Years and 5 Months, but does not commence till the End of 4 Years, has disposed of it for the present Payment of 1220*l.* 2*s.* 2*d.* allowing 3 per Cent. to the Purchaser; what is the Yearly Income?
54. There is a Lease of a House taken for $7\frac{1}{2}$ Years, but not to commence until the End of 5 Years, the Lessee would sell the same for 419*l.* 15*s.* 1*d.* present Payment, allowing $4\frac{1}{2}$ per Cent. to the Purchaser; what is the yearly Rent?
55. There is a Legacy of a certain Rate per Annum, for 10 Years, left to a Person of 14 Years of Age; but the Time of Payment is not to commence till the said Person's Age be 21 Year's; but he wanting a Sum of Money sold it for 241*l.* 19*s.* 6,074*d.* allowing 5 per Cent. to the Buyer, I demand the yearly Rate?

60. REBATE or DISCOUNT.

Here S represents the Sum to be discounted, P the present Worth, T and R as before.

When S, T, and R, are given, to find P.

$$\text{THEOREM 19. } \frac{S}{Tr+1} = P.$$

E X A M P L E S.

56. What is the present Worth of 150*l.* due 9 Months hence, at 5 per Cent.?
57. What is the present Worth of 1000*l.* due at 5 Months at $4\frac{1}{2}$ per Cent.?
58. What is the Discount of 9342*l.* at 4 per Cent. for 10 Months?

When P, T, and R, are given, to find S.

$$\text{THEOREM 20, } pTr+p=S.$$

E X A M P L E S.

59. Suppose I receive 144*l.* 11*s.* 6 $\frac{3}{4}$ *d.* now for a Sum of Money due 9 Months hence, allowing 5 per Cent. for present Payment: I demand the Sum that was due at first?
60. If the present Worth of a Sum of Money due 5 Months hence, allowing $4\frac{1}{2}$ per Cent. to be 981*l.* 10*s.* 5*d.* what was the Sum first due?
61. A Person paid 9111*l.* 3*s.* 8 $\frac{1}{2}$ *d.* for a Debt due 10 Months hence, he being allowed 4 per Cent. for the Discount, how much was the Debt?

When S, P, and R, are given, to find T.

$$\text{THEOREM 21. } \frac{S-P}{Pr} = T.$$

E X A M P L E S.

62. The present Worth of 150*l.* due for a certain Time to come is 144*l.* 12*s.* 6 $\frac{3}{4}$ *d.* at 5 per Cent. I demand in what Time the first Sum should have been paid if no Rebate had been made?

63. A Person receives 981*l.* 10*s.* 5*d.* for 100*l.* due at a certain Time to come, allowing 4½ per Cent. Discount; I desire to know in what Time the Debt should have been discharged without any Rebate?
64. I have received 911*l.* 3*s.* 8½*d.* for a Legacy of 9342*l.* allowing the Executor 4 per Cent. I demand when the Legacy was payable without Rebate?

When S, P, and T, are given, to find R.

$$\text{THEOREM 22. } \frac{s-p}{pr} = R.$$

E X A M P L E S.

65. At what Rate per Cent. will 150*l.* payable 9 Months hence, produce 144*l.* 11*s.* 6¾*d.* for the present Payment?
66. At what Rate per Cent. will 1000*l.* payable at 5 Months hence, produce 981*l.* 10*s.* 5*d.* for the present Payment?
67. At what Rate per Cent. will 9342*l.* payable 10 Months hence, produce 911*l.* 3*s.* 8½*d.* for the present Payment?

61. EQUATION of PAYMENTS.

To find the equated Time for the Payment of any Sum of Money, due at several Times.

R U L E.

1. Find the present Worth of each Payment for its respective Time. | Thus Theorem 23. $\frac{s}{1r+1} = P.$
2. Add all the present Worths together, and call that Sum P, then will $s-p=D$; the Rebate.
3. And $\frac{d}{pr} = E$, the true equated Time.

E X A M P L E S.

68. B. owes C. 1400*l.* which was to have been paid as follows; 400*l.* down, 500*l.* at the End of 6 Months, 250*l.* at the End of 8 Months, and the Rest at the End of 10 Months;

Months; but they agree to have but one Payment of the whole, Rebate at $3\frac{1}{2}$ per Cent. the true equated Time is demanded?

69. In what Time will the Interest of 49*l.* 3*s.* equal the Proceed of 12*l.* 6*s.* at Use 47 Days, at any Rate of Interest?

70. Put out 384*l.* to Interest, and in $8\frac{1}{2}$ Years there were 542*l.* 8*s.* found to be due; what Rate of Interest could then be implied?

62. COMPOUND INTEREST.

The Letters made use of here, are,

A, the Amount.

P, the Principal.

T, the Time.

R, the Amount of 1*l.* for 1 Year, at any given Rate, which is found by the following Proportion.

Thus,

$$\text{As } \begin{cases} 100 : 105 :: 1 : 1,05 = R, \text{ at } 5 \text{ per Cent.} \\ 100 : 106 :: 1 : 1,06 = R, \text{ at } 6 \text{ per Cent. \&c.} \end{cases}$$

When P, T, and R, are given, to find A.

$$\text{THEOREM 1. } p \times r^t = A.$$

E X A M P L E S.

1. What will 246*l.* 10*s.* amount to in 7 Years, at 5 per Cent. per Annum?
2. What will 500*l.* amount to in 30 Years or Days, at $4\frac{1}{2}$ per Cent.?
3. What is the Amount of 523*l.* in 5 Years and 194 Days, at 5 per Cent.?

When A, R, and T, are given, to find P.

$$\text{THEOREM 2. } \frac{A}{R} = P.$$

E X A M P L E S.

4. What Principal, or Sum of Money, must be put out to raise a Stock of 243*l.* 2*s.* $\frac{1}{4}$ *d.* in 4 Years, at 5 per Cent. per Annum?

5. What

5. What Principal, being put to Interest, will amount to 34 *l.* 17*s.* in 7 Years, at 5 per Cent. per Annum?
6. What Principal, being put to Interest for 30 Years, at $4\frac{1}{2}$ per Cent. per Ann. will amount to 1872*l.* 13*s.* 2*d.*?
7. What Principal, being put to Interest for 5 Years and 194 Days, will amount to 685*l.* 7 $\frac{1}{2}$ *d.* at 5 per Cent. per Ann.?

When P, A, and R, are given, to find T.

THEOREM 3. $\frac{a}{p} = R^t$. $\left\{ \begin{array}{l} \text{which being continually divided} \\ \text{by } r, \text{ till nothing remains, the} \\ \text{Number of those Divisions will} \\ \text{be equal to T, the Time.} \end{array} \right.$

E X A M P L E S.

8. In what Time will 246*l.* 10*s.* amount to 346*l.* 17*s.* at 5 per Cent. per Annum?
9. In what Time will 530*l.* amount to 1872*l.* 13*s.* 2*d.* at $4\frac{1}{2}$ per Cent. per Annum?
10. In what Time will 523*l.* amount to 685*l.* 7 $\frac{1}{2}$ *d.* at 5 per Cent. per Annum?

When A, P, and T, are given, to find R.

THEOREM 4. $\frac{a}{p} = R^t$. $\left\{ \begin{array}{l} \text{which being extracted by the Rules} \\ \text{of Extraction (the Time given to} \\ \text{the Question shewing the Power)} \\ \text{will give the Rate.} \end{array} \right.$

E X A M P L E S.

11. At what Rate per Cent. will 146*l.* 10*s.* amount to 346*l.* 17*s.* in 7 Years?
12. At what Rate per Cent. will 500*l.* amount to 1872*l.* 13*s.* 2*d.* in 30 Years?
13. At what Rate will 523*l.* amount to 685*l.* 7 $\frac{1}{2}$ *d.* in 5 Years and 195 Days?

70. ANNUITIES, PENSIONS in ARREARS.

Here U represents the Annuity, Pension, or yearly Rent, A, R, and T, as before.

When

When U, T, and R, are given, to find A.

$$\text{THEOREM 5. } \frac{U r^T - u}{r - 1} = A.$$

E X A M P L E S.

14. What will an Annuity of 70*l.* per Annum (payable yearly) amount to in 4 Years, allowing 4 per Cent. per Ann?
15. If a Salary of 100*l.* per Annum, to be paid yearly, be forborne 6 Years, or unpaid, at 5 per Cent. per Ann. what is the Amount?
16. A Minor of 14, had an Annuity left him of 70*l.* a Year, the Proceed of which, by Will, was to be put out, both Principal and Interest, yearly, as it fell due, at 3 per Cent. till he should attain to 21 Years of Age; the utmost Improvement being made of this Part of his Fortune, what had he then to receive?
17. If an Annuity of 30*l.* per Annum, payable yearly be omitted to be paid for 30 Years, at $3\frac{1}{2}$ per Cent. what is the Amount?

When A, T, and R, are given, to find U.

$$\text{THEOREM 6. } \frac{ar - a}{rt - 1} = U.$$

E X A M P L E S.

18. What Pension being forborne 6 Years, at 5 per Cent. will amount to 680*l.* 3*s.* 9*d.* 6288?
19. What Annuity will amount to 536*l.* 7*s.* 5*d.* 45984 in 7 Years, at 3 per Cent.?
20. If the Payment of an Annuity be forborne 30 Years amount to 1548*l.* 13*s.* 7*d.* at $3\frac{1}{2}$ per Cent. What is the Annuity?

When U, A, and R, are given, to find T.

$$\text{THEOREM 7. } \frac{ar + u - a}{u} = R^T. \left\{ \begin{array}{l} \text{Which proceed with as in} \\ \text{Theorem the 3d, which} \\ \text{will give T the Time.} \end{array} \right.$$

E X A M P L E S.

17. In what Time will a Salary of 100*l.* per Annum amount to 680*l.* 3*s.* 9½*d.* at 5 per Cent.?
18. In what Time will an Annuity of 70*l.* amount to 536*l.* 7*s.* ½*d.* 45984 at 3 per Cent.?
19. In what Time will 30*l.* per Annum, amount to 1548*l.* 13*s.* 7½*d.* 45984 at 3½ per Cent.?

When A, U, and T, are given, to find R.

$$\text{THEOREM 8. } \frac{ar}{u} - r = \frac{a-u}{u} = R.$$

E X A M P L E S.

20. At what Rate per Cent. per Annum, will a Salary of 100*l.* per Annum, amount to 686*l.* 3*s.* ½*d.* 6288 in 6 Years?
21. At what Rate per Cent. per Annum, will an Annuity of 70*l.* per Annum, amount to 536*l.* 7*s.* ½*d.* 45984 in 7 Years?
22. At what Rate per Cent. per Annum, will a Salary of 30*l.* per Annum, amount to 1548*l.* 13*s.* 7½*d.* 0264 in 30 Years?

When U, R, and T, are given, to find P.

$$\text{THEOREM 9. } u - \frac{u}{r^t} : \div r - 1 = P.$$

E X A M P L E S.

23. What is the present Worth of an Annuity of 50*l.* per Annum, to continue 8 Years at 5 per Cent.?
24. What is the present Worth of an Annuity or yearly Rent of 60*l.* to continue 6 Years at 4 per Cent.?
25. What is the present Worth of a Pension of 1000*l.* per Annum, for 21 Years, at 4½ per Cent.?

When P, T, and R, are given, to find U.

$$\text{THEOREM 10. } \frac{prt \times r - prt}{r^t - 1} = U.$$

E X A M P L E S.

26. If the present Worth of 323*l.* 3*s.* 2½*d.* 368 were required for a Pension of 8 Years to come, at 5. per Cent. what was the Pension?
27. What Annuity or yearly Rent may be purchased for 314*l.* 10*s.* 6¾*d.* 08544 at 4 per Cent. for 6 Years?
28. Suppose the present Worth of a Pension for 21 Years, at 4½ per Cent. was 13404*l.* 14*s.* 5½*d.* 944, what was the Pension?

When U, P, and R, are given, to find T.

THEOREM II. $\frac{u}{p+u-pr} = R.$

{ Which proceed with
as in Theorem 3, will
give T.

E X A M P L E S.

29. How long may one have a Lease of 50*l.* yearly Rent for 323*l.* 3*s.* 2½*d.* 368, allowing 5 per Cent. to the Purchaser?
30. If an Annuity of 60*l.* is purchased for 314*l.* 10*s.* 6¾*d.* 08544, at 4 per Cent. what Time ought it to continue?
31. I demand what Time a Lease of 1000*l.* may be purchased for, when the present Worth of 13404*l.* 14*s.* 5½*d.* is made at 4½ per Cent.?

When U, P, and T, are given, to find R.

THEOREM 12. $\frac{u}{p} = \frac{u}{p} R + R - R + 1.$

E X A M P L E S.

32. If an Annuity of 50*l.* to continue for 8 Years, be purchased for 323*l.* 3*s.* 2½*d.* 368, what Rate of Interest hath the Purchaser for his Money?
33. Suppose I give 314*l.* 10*s.* 6¾*d.* 08544, for an Annuity of 60*l.* to continue 6 Years, at what Rate was Interest allowed?
34. If an Annuity of 1000*l.* to continue 21 Years be purchased for 13404*l.* 14*s.* 5½*d.* 944, what Rate of Interest is the Purchaser allowed for his Money?

64. ANNUITIES, LEASES, &c. taken in REVERSION.

To find the present Worth of Annuities, &c. in Reversion.

R U L E S.

1. Find the present Worth of the Annuity, &c. at the given Rate, and for the Time of its Continuance, by Theorem 9.

Thus,

$$U - \frac{u}{r} : \div r - 1 = P.$$

2. Change P into A, and find what Principal being put to Interest will amount to P at the same Rate and Time to come before the Annuity commences, by Theorem 2, which will give the present Worth of the Annuity.

$$\text{Thus } \frac{A}{R^t} = P.$$

E X A M P L E S.

35. What is the present Worth of a Reversion of a Lease of 8c/ per Annum, to continue 6 Years, but not to commence till the End of 2 Years, allowing 5 per Cent. to the Purchaser?
36. What ought a Person to give down in ready Money for the Reversion of 1000c/ a Year, to continue 20 Years, on a Lease which cannot commence till 5 Years are at an End, allowing the Purchaser 5 per Cent.?

To find the yearly Income of an Annuity taken in Reversion.

R U L E S.

1. Find the Amount of the present Worth at the given Rate, and for the Time before the Annuity commences, by Theorem 1.

$$\text{Thus, } prt = A.$$

2. Change A into P, and find what yearly Rent, &c. being sold, will produce P at the same Rate, and for the Time of its Continuance, by Theorem 10.

$$\text{Thus, } \frac{\overline{prt \times r} - prt}{r^t - 1} = U.$$

E X A M P L E S.

37. What Annuity, to be entered upon two Years hence, and then continue 6 Years, may be purchased for 368*l.* 6*s.* 1*d.* ready Money, allowing 5 per Cent. to the Purchaser?
38. Suppose the present Worth of a Lease of an Estate is 8132*l.* 14*s.* 8*d.* 064, taken in Reversion for 20 Years, but not to commence till the End of 5 Years, allowing 5 per Cent. to the Purchaser; what is the yearly Rent?

65. REBATE or DISCOUNT.

Here *S* represents the Sum to be purchased.

When *S*, *T*, and *R*, are given, to find *P*.

THEOREM 13. $\frac{S}{rt} = P.$

E X A M P L E S.

39. What is the present Worth of 150*l.* payable 4 Years hence, at 5 per Cent.?
40. What is the present Worth of 743*l.* 4*s.* 9*d.* payable 6 Years hence at 4 per Cent.?

When *P*, *T*, and *R*, are given, to find *S*.

THEOREM 14. $p \times rt = S.$

E X A M P L E.

41. If 123*l.* 8*s.* 1*½d.* be received for a Debt payable 4 Years hence, and an Allowance of 5 per Cent. to the Debtor for present Payment, what was the Debt?
42. If a Sum of Money due 6 Years hence produce 587*l.* 7*s.* 9*¾d.* 718, for present Payment, Rebate being made at 4 per Cent. I demand how much the Debt was?

When *S*, *P*, and *R*, are given, to find *T*.

THEOREM 15. $\frac{S}{p} = rt$ } which proceed with as in Theorem 3.

† *P*

E X-

E X A M P L E S.

43. A Person received 123*l.* 8*s.* 11*d.* for a Debt of 150*l.* Rebate being made at 5 per Cent. I demand in what Time the Debt was payable?
44. The present Payment of 587*l.* 7*s.* 9½*d.* 718, is made for a Debt of 743*l.* 4*s.* 9*d.* Rebate at 4 per Cent. I demand when the Debt was payable?

When S, P, and T, are given, to find R.

THEOREM 16. $\frac{S}{P} = R^T$ } Which proceed with as in Theo-
rem 4.

E X A M P L E S.

45. The present Worth of 150*l.* payable 4 Years hence, is 123*l.* 8*s.* 11½*d.* at what Rate per Cent. is the Rebate made at?
46. The Sum of 74*l.* 4*s.* 9*d.* is payable in 6 Years Time, and the present Value of that Sum is 587*l.* 7*s.* 9½*d.* 718, I demand at what Rate per Cent. the Rebate must be made?

6. PURCHASING Freehold or Real ESTATES,

Is to find the present Worth of an Annuity, &c. to continue for ever.

When U, and R, are given, to find P.

THEOREM 17. $\frac{U}{r-1} = P.$

E X A M P L E S.

47. Suppose a Freehold Estate of 500*l.* per Annum were to be sold; what is the Worth, allowing 5 per Cent. to the Buyer?
48. What is an Estate of 25*l.* per Annum, to continue for ever, worth in present Money, allowing 4½ per Cent. to the Buyer?

When

When P, and U, are given, to find R.

THEOREM 18. $\frac{P+u}{p} = R.$

E X A M P L E S.

49. Suppose one gave 10000*l.* for a Freehold Estate of 5*sh.* per Annum, what Rate per Cent. has the Purchaser for his Money?
50. If an Estate of 25*l.* per Annum is bought for 555*l.* 11*s.* 1*½d.* what is the Rate per Cent.?

When P, and R, are given, to find U.

THEOREM 19. $\overline{P \times r - 1} = U$.

E X A M P L E S.

51. Suppose a Person would lay out 10000*l.* on a Freehold Estate, and so as to be allowed 5 per Cent. for his Money, what must be the annual Rent of such an Estate?
52. If a Freehold Estate is bought for 555*l.* 1*l.* 1*l.* and the Allowance of $4\frac{1}{2}$ per Cent. is made the Buyer; what is the yearly Rent?

67. Purchasing FREEHOLD ESTATES in REVERSION.

To find the Worth of a Freehold Estate in Reversion.

R U L E S.

1. Find the Worth of the yearly Rent, &c.
2. Change P into A , and find what Principal being put to Interest will amount to A , at the same Rate, and for the Time to come before the Estate commences.

Theo. 20. Thus $\frac{n}{r-1}$

Thus $\frac{A}{R_s} = P.$

E X A M P L E.

53. What is an Estate of 500*l.* per Annum worth in ready Money, to continue for ever, but not to commence
 † P 2 till

till the End of 4 Years, allowing 5 per Cent. to the Purchaser?

To find the yearly Rent of an Estate taken in Reversion,

R U L E S.

1. Find the Amount of the Worth of the Estate at the given Rate, and the Time before it commences.
2. Change A into P, and find what yearly Rent being fold will produce P at the same Rate.

$$\text{Theo. 21. } p \times r^t = A.$$

$$\frac{Pr \times r - pr}{r} = U.$$

E X A M P L E.

54. A Freehold Estate is sold for 8227*l.* 1*s.* 4*d.* which does not commence till the End of 4 Years, the Buyer being allowed 5 per Cent. for his Money: I desire to know the yearly Income?

I X A M P L E S
T H E
YOUNG ARITHMETICIAN'S
A S S I S T A N T.

P A R T - I V.

68. M E N S U R A T I O N.
68. S U P E R F I C I A L M E A S U R E.

P R O B L E M I.

To multiply Feet, Inches, and Parts, by Feet, Inches, and Parts, which Method is termed *Cross Multiplication*, but more properly *Duodecimal*.

R U L E.

Set the Feet in the Multiplier under the least Denomination in the Multiplicand, and the Rest in Order, beginning with the least Denomination; divide each Product by 12 as you go on; place the first Remainder under the multiplying Figure, and the Rest in Order, adding each Quotient to the next arising Product, as in S. & C. 9. and having thus finished Multiplication, the Sum of all will be the Product required.

In general, thus,

When Feet are concerned, the Product is of the same Denomination with the Term multiplying Feet.

† P 3

When

When Feet are not concerned, the Name of the Product will be expressed by the Sum of the Indices of the two Factors.

E X A M P L E S.

1. Multiply 17 Feet, 7 Inches, by 6 Feet.
2. Multiply 47 Feet, 8 Inches, by 8 Feet, 4 Inches.
3. Multiply 7 Feet, 10 Inches, by 8 Feet, 6 Inches.
4. Multiply 64 Feet, 7 Inches, by 4 Feet, 8 Inches.
5. Multiply 12 Feet, 8 Inches, 9 Parts, by 9 Feet, 6 Inches, 7 Parts.
6. Multiply 9 Feet, 11 Inches, 6 Parts, by 11 Feet, 8 Inches.
7. Multiply 64 Feet, 10 Parts, by 14 Feet, 9 Inches.
8. Multiply 124 Feet, 4 Inches, by 42 Feet, 9 Seconds.
9. Multiply 16 Feet, 7 Inches, 10 Parts, by 6 Feet, 5 Inches, 7 Seconds.
10. Multiply 474 Feet, 6 Inches, 8 Seconds, by 186 Feet, 7 Inches, 4 Seconds.
11. Multiply 24 Feet, 11', 8'', 6''', 7''', by 8 Feet, 6', 7''.
12. Multiply 46 Feet, 6 In. 8'', 4''', by 6 Feet, 4 In. 8'', 6'''.

P R O B L E M II.

To find the Area of a Parallelogram, whether it be a Square, a Rectangle, a Rhombus, or a Rhomboides.

R U L E.

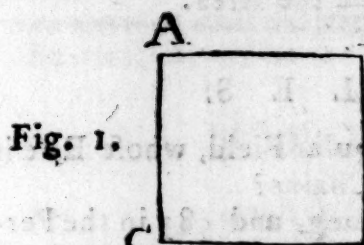
Multiply the Length by the Height or perpendicular Breadth, and the Product will be the Area.

If the Area of a Piece of Ground, in Yards, is divided by 4840 (the Number of square Yards in one Acre) the Quotient will give the Number of Acres in the said Piece. Or

If the Area in Links, be divided by 100000 (the Number of square Links in one Acre) the Quotient will give Acres.

That

That is $AB \times AC = \text{the Area.}$



EXAMPLES.

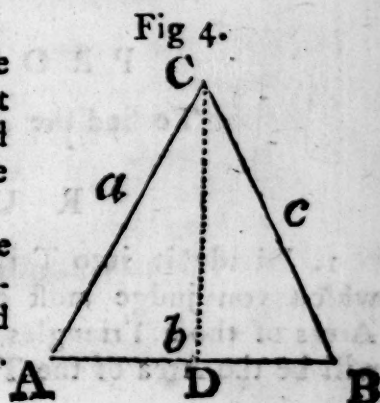
1. What is the Area in Acres of a Parallelogram whose Length is 14,5 Chains, and its Breadth 9,75 Chains.
2. What is the Area of a Square, whose Side is 245 Yards or Chains, &c.
3. How many square Yards of Paving are there in a Court-Yard, being in the Form of a Rhombus or Rhomboides, whose Length is 64 Feet, 6 Inches, and perpendicular Breadth is 47 Feet, 8 Inches?

PROBLEM III.

To find the Area of a Triangle.

RULES.

1. Multiply one of its Sides by the Perpendicular let fall upon it from its opposite Angle, and Half the Product will be the Area.
2. Multiply the Base by Half the Perpendicular, or Perpendicular by Half the Base, and the Product gives the Area.



That

That is, $\frac{AB \times CD}{2} = \text{the Area.}$

E X A M P L E S:

4. How many Acres are in a triangular Field, whose Base is 28, and Perpendicular 20,5 Chains?
5. A Triangular Field 738 Links long, and 583 in the Perpendicular, brings in 12 $\frac{1}{2}$ a Year. What is it let at per Acre?

When the three Sides of a Triangle are given, to find the Area.

R U L E.

3. From Half the Sum of the three Sides subtract each Side severally; multiply the Half Sum and the three Remainders continually together, and the Square Root of the last Product will be the Area of the Triangle, that is, $\frac{a+b+c}{2} = s = \text{Half the Sum of the Sides.}$

Then let $s-a=e$, and $s-b=f$, also $s-c=g$; $\therefore \sqrt{sefg} = \text{the Area.}$ — Note. $a=AC$, $b=AB$, and $c=BC$. See the last Figure.

E X A M P L E.

6. Suppose I have a Fish-Pond of a triangular Form, whose three Sides measure 400, 348, and 312 Yards; what Quantity of Ground does it contain.

P R O B L E M IV.

To find the Area of a Trapezium.

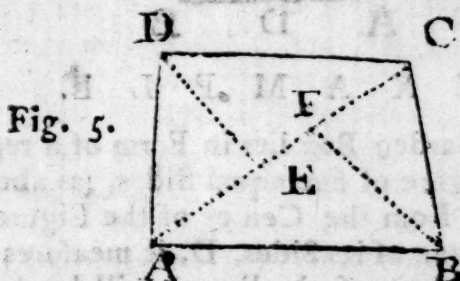
R U L E S.

1. Divide it into Triangles according to the Manner which you judge most convenient; then the Sum of the Areas of those Triangles, calculated by the last Problem, will be the Area of the Trapezium. Or,

2. Multiply.

2. Multiply the Sum of the Perpendiculars by Half the Diagonal, and the Product will give the Area; or multiply the Sum of the Perpendicular by the Diagonal, and Half the Product will be the Area.

That is, $\frac{DE+BF}{2} \times AC = \text{the Area.}$



Or, 3. Subtract severally each Side from Half the Sum of the four Sides, and the square Root of the Product of the four Remainders will be the Area required.

E X A M P L E.

7. How many square Yards of Paving are there in a Trapezium, ABCD, whose Diagonal, BD, 45 Feet, and the Perpendiculars, AE, equal to 17,25, CF, equal to 14 Feet?

8. Suppose the four Sides of a Trapezium are 15.60; 13.20; 10, and 26 Chains: Quere the Area.

P R O B L E M V.

To find the Area of any regular Polygon.

R U L E I.

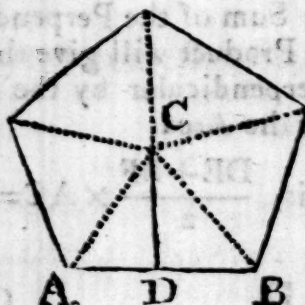
Let fall a Perpendicular from the Center of the Figure to one of its Sides, then multiply together the Perpendicular, the Side of the Figure, and the Number of its Sides, and Half the Product will be the Area.

Here the Number of Sides is 5 = N.

Then it is, $\frac{AB \times CD \times n}{2} = \text{the Area.}$

Fig.

Fig. 6.



E X A M P L E.

9. A Piece of Garden Box lies in Form of a regular Pentagon, or Figure of five equal Sides, (as above) each 48 Feet; and from the Center of the Figure, C, to the Middle of one of its Sides, D, it measures 41,57 Feet nearly, the Area of the Figure will be the Content of these five Triangles. Play, what is that?

P R O B L E M VI.

To find the Diameter and Circumference of a Circle, the one from the other.

R U L E S.

1. Multiply the Diameter by 3,1416, and the Product will be the Circumference. And therefore,
2. Divide the Circumference by 3,1416, and the Quotient will be the Diameter.
3. See Sect. 54, Case 3.

E X A M P L E S.

12. If the Diameter of a Circle be 7, what is the Circumference?
13. What is the Diameter of a Circle whose Circumference is 22?
14. What is the Circumference of the Earth, supposing it to be perfectly round, and its Diameter is 8000 Miles?

P R O B L E M VII.

To find the Area of a Circle.

R U L E S.

R U L E S.

1. Multiply Half the Circumference by Half the Diameter, and the Product will be the Area. Or,
2. Multiply the Square of the Diameter by ,7854, and the Product will be the Area. Or,
3. Multiply the Square of the Circumference by ,079574, and the Product will be the Area. Or,
4. Multiply the Square of the Semi-Diameter by 3,1416, and the Product will be the Area. Or,
5. Multiply the Circumference by the Diameter, and a fourth Part of the Product will express the Area.

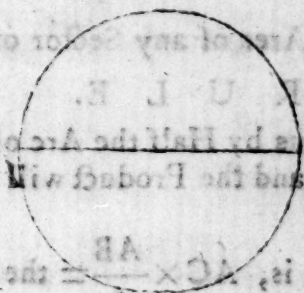
III. ,7854, and 3,1416, are Areas of Circles whose Diameters are 1 and 2, and ,079577 is the Area of a Circle whose Circumference is 1; likewise 452, and 1,273239, are Squares of the Diameters of Circle, whose Areas are 355, and 1, and 12831 is the Diameter of a Circle, whose Area is equal to a Square whose Side is 1. For if the Diameter be Unity or 1, the Circumference will be 3,1415926, then per Rule I. $\frac{3,1415926}{2} \times \frac{1}{2} = ,78539816$, or rather ,7854, the Area. Also, if the Diameter be 2, the Circumference will be 6,2831853, then per Rule I. $\frac{6,2831853}{2} \times \frac{2}{2} = 3,1415926$, or rather, 3,1416, the Area. Likewise $\frac{1}{3,1416} \times 1 \div 4 = ,079477$ the Area, &c.

Let C = the Circumference, and D = the Diameter, A B.

Then per Rule I. $\frac{C}{2} \times \frac{D}{2} =$ the Area.

PROBLEM IX.

Fig. 7.

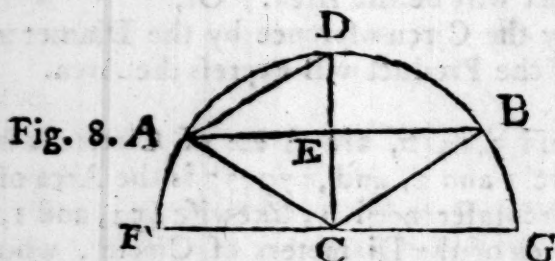


E X A M P L E S.

15. How many Square Feet are in a Circle whose Circumference is 6,2832?
 16. What is the Area of a Circle whose Diameter is 12?

P R O B L E M VIII.

To find the Length of any Arc of a Circle, ADB.



R U L E.

Multiply together the Radius, DC, the Number of Degrees in the given Arc, and the Number ,01745329, (b) the last Product will be the Length of the Arc; for, when the Radius is 1, Half the Circumference is 3,14159265, &c. and therefore, $\frac{3,14159265}{180 \text{ Degrees}} = ,01745329$, or, ,0174533, nearly which is the Length of an Arch of 1 Degree.

Hence $CD \times ADB \times b = \text{the Length of the Arc, ADB.}$

E X A M P L E.

17. What is the Length of the Arc, ADB, which is 29,5 Degrees, and Radius 9.

P R O B L E M IX.

To find the Area of any Sector of a Circle.

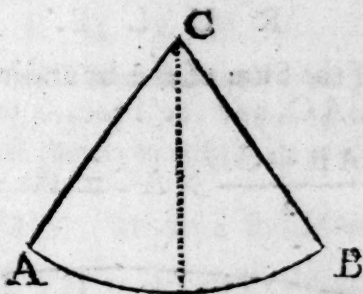
R U L E.

Multiply the Radius by Half the Arc of the Sector, found by the last Problem, and the Product will be the Area, as in the whole Circle.

That is, $AC \times \frac{AB}{2} = \text{the Area.}$

Fig. 9.

Fig. 9.



E X A M P L E.

18. What is the Area of a Sector, whose Radius, CA, is 55, and the Length of the Arc. AB, 59.

P R O B L E M X.

To find the Area of the Segment of a Circle, ADB, whose Center is E. (See Fig. 8.)

R U L E.

Find the Area of the Triangle ABC, by Prob. III. and of the Sector, ADBC, by the last Problem, their Difference, or Sum of these Areas, will be that of the Segment, according as it is less or greater than a Semi-Circle.

To fix Times the Base AB, (see Fig. 8.) add eight Times the Chord of Half the Arch AB, viz. AD, multiply the Sum by the Altitude DE, divide the Product by 15, and the Quotient will nearly give the Area.

E X A M P L E S.

19. Suppose the Diameter FG of a Circle to be 84 Inches, and the Height of the Segment, ED, 50 Inches, what will its Area be? (See Fig. 8.)
20. What is the Area of a Segment whose Arc is a Quadrant, or contains 90 Degrees, and Diameter 18 Feet?

P R O B L E M XI.

To find the Area of a Segment of a Sector, ABCD, or the Fronts of an Arch built with Stones of equal Length.

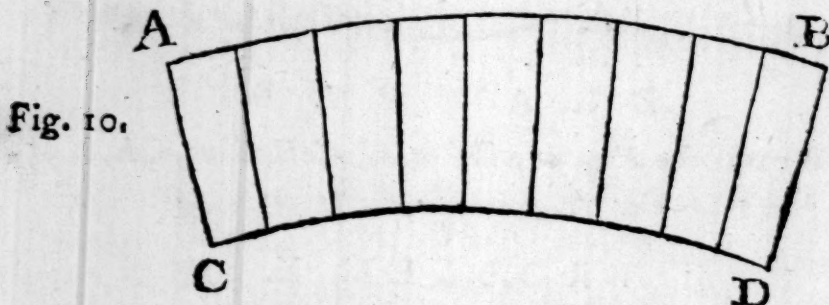
† Q

R U L E.

R U L E.

Multiply Half the Sum of the bounding Arches, ABCD, by the Distance, AC, and the Product will give the Area.

That is, $\frac{AB + CD}{2} \times AC =$ the Area nearly.



E X A M P L E S.

21. What is the Area of the Front of an Arch built with Stones $3\frac{1}{2}$ Feet Long, whose upper and lower bounding Arcs are in Length 84 and $72\frac{1}{2}$ respectively?
22. What is the Area contained between two concentric Semi-Circles, whose Diameters are 24 and 16?

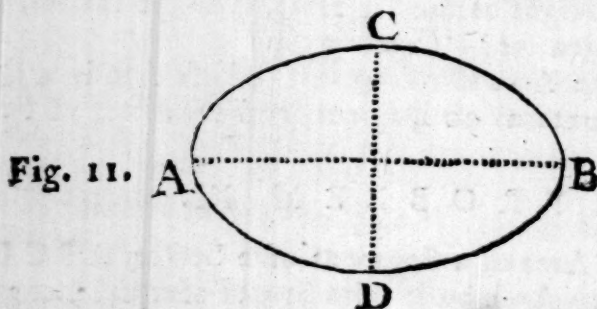
P R O B L E M XII.

To find the Area of an Ellipsis, or Oval.

R U L E.

Multiply continually together the two Axes, and the Number ,7854 (b) and the Product of these three Numbers will express the Area.

That is, $b \times AB \times CD =$ the Area.



E X-

E X A M P L E.

23. What is the Area of an Ellipsis whose greatest Diameter is 24, and least Diameter 18?

O F A R T I F I C E R S W O R K S.

I. GLAZIERS and MASONS FLAT WORK is measured by the Foot Square.

E X A M P L E S.

1. What is the Content of 12 Panes of Glass, each measuring 3 Feet 10 Inches long, and 2 Feet 8 Inches broad; What will the Glazing come to at $8\frac{1}{2}d.$ per Foot?
2. There is a House with 3 Tier of Windows, 4 in a Tier, the Height of the first Tier is 6 Feet 6 Inches, the second $5\frac{1}{4}$ Feet, and the third $4\frac{3}{4}$ Feet, the Breadth of each Window is three Feet 9 Inches; what will the Glazing come to at $16d.$ per Foot?
3. What is the Price of a Marble Slab whose Length is $6\frac{1}{2}$ Feet, and Breadth $3\frac{1}{4}$ Feet, at $8s.$ per Foot?
4. A Looking-Glass is 16 Inches by 9, and contains a Foot of Glass; what will the Content of the Plate be that has twice the Length, and three Times the Breadth?

II. PAINTING, PLAISTERING, PAVING, &c. is measured by the Yard Square, which is 9 Square Feet.

R U L E.

Divide the Square Feet by 9, and the Quotient will be the Number of Square Yards.

E X A M P L E S.

5. What will the Paving of a Street come to at $6d.$ per Yard, the Length of the Street being $176\frac{1}{2}$ Feet, and the Breadth $56\frac{1}{4}$ Feet?
6. What is the content of a Piece of Wainscoting in square Yards, that is $9\frac{1}{2}$ Feet in Height, and $8\frac{1}{4}$ Feet broad, and what will it come to at $6s.$ per Yard?
7. There is a Room 84 Feet round, and 9 Feet 6 Inches high, in which are three Windows, each 6 Feet high

† Q 2

and

and 3 Feet 5 Inches wide, and the Fire Place 4 Feet by 4 Feet; I demand how many Yards of Paper, Half-Yard wide, will hang it?

8. If my Court-Yard be 47 Feet 7 Inches square, and I have laid a Footway of Purbeck Stone 4 Feet wide along one Side of it; what will paving the Rest with Flints come to, at 6*d.* per Yard square?
9. A rectangular four-sided Room measures $129\frac{1}{2}$ Feet about, and is to be wainscotted at 3*s.* 6*d.* per Yard square; after the due Allowances for Girt of Cornice and Member, it is $16\frac{1}{2}$ Feet high; the Door is seven Feet by $3\frac{3}{4}$ Feet, the Window Shutters, two Pair, are $7\frac{1}{4}$ Feet by $4\frac{1}{2}$ Feet; the Check Boards round them come $1\frac{1}{4}$ Foot below the Shutters, and are 14 Inches in Breadth; the lining Boards round the Door-Way are 16 Inches broad; the Door and Window Shutters being wrought on both Sides, are reckoned Work and Half, and paid for accordingly; the Chimney $3\frac{1}{2}$ Feet by 3 Feet, not being inclosed, is to be deducted from the superficial Content of the Room; and the Estimate of the Charge is required?
10. What will Plaistering of a Cieling, at $10\frac{1}{2}$ *d.* per Yard, come to, supposing the Length $34\frac{1}{2}$ Feet, and the Breadth 20 Feet?
11. There is a Quantity of Partitioning that measures 34 Feet 8 Inches about, and $14\frac{1}{2}$ Feet high; but is rendered between Quarters: The Lathing and Plaistering will be 8*d.* per Yard, and the Whiting 2*d.* per Yard; what will the Whole come to?

Note. In measuring Plaistering, rendering between Quarters, there is commonly a fifth Part of the whole Area deducted; but when rendering between Quarters is whited or coloured, there is commonly a fourth or fifth Part added to the whole Area, for Sides of the Quarters and Braces, &c.

III. FLOORING, PARTITIONING, ROOFING, TYLING, &c. is measured by the Square of 100 Feet.

In these Measurements, the Dimensions are taken by a Rod of 10 Feet long; and therefore the Result is in Squares of 100 Square Feet each.

Hence, dividing the Area in square Feet by 100, the Quotient will be the Number of Squares required.

E X A M P L E S.

12. In $120\frac{1}{2}$ Feet in Length, and $12\frac{1}{4}$ Feet in Height of Partitioning, how many Squares?
13. What Difference is there between a Floor 28 Feet long, by 20 broad, and two others that measure 14 Feet a-piece by 10; and what do all three come to, at 2*l.* 5*s.* per Square?
14. Suppose a House three Stories, besides the Ground Floor, was to be floored, at 8*l.* 10*s.* per Square, the House measures $30\frac{1}{2}$ Feet by $20\frac{1}{2}$ Feet, there are eight Fire Places, whose Measure are four of 6 Feet by $5\frac{1}{4}$, and four of $4\frac{1}{4}$ Feet, by 4, and the Well Hole for the Stairs is 10 Feet by $8\frac{1}{2}$; what will the Whole come to?
15. How many Oaken Planks will floor a Room $60\frac{1}{2}$ Feet long, and $33\frac{1}{2}$ wide, supposing the Plank 15 Feet long, and $1\frac{1}{4}$ wide?
16. Suppose a House measures, within the Walls, 64 Feet in Length, and 36 Feet in Breadth, and to be of a true Pitch, what will it come to roofing, at 12*s.* 6*d.* the Square?
17. Suppose I employ a Person to thatch a Barn, which is 70 Feet long, and 30 deep; I demand how many Squares are contained in the Whole; also what it will come to at 10*s.* 8*d.* per Square?
18. What will the new Ripping an Out-House cost, that measures $32\frac{1}{4}$ Feet long, by $22\frac{1}{4}$ broad, upon the flat, at 15*s.* the Square; the Eaves Boards projecting 10 Inches on each Side?

Note. In Tyling and Roofing, it is customary to reckon the Flat, and Half of any Building within the Walls, to be the Depth or Width of the Roof of that Building; when the said Roof is of a true Pitch, that is, when the Rafter is $\frac{1}{4}$ of the Breadth of the Building: But when the Roof is more or less than the true Pitch, they measure from one Side to the other.

IV. BRICKLAYER'S WORK is measured by the Rod, of $272\frac{1}{4}$ Square Feet.

This Work is always valued at the Rate of a Brick and a Half thick, and if the Thickness of the Wall is more or

less, it must be reduced to that Thickness, by the following

R U L E S.

1. Multiply the Area of the Wall in Feet, by the Number of half Bricks in the Thickness; divide the Product by $816\frac{1}{2}$, and the Quotient will be the Content in Rods:
Or,
2. Multiply the Area of the Wall by the Number of half Bricks the Thickness of the Wall is of; the Product divided by 3, gives the Area in Feet, which divide by $272\frac{1}{4}$, the Quotient will be the Rods required.

Note. The Fraction $\frac{1}{2}$ in Rule 1, or $\frac{1}{4}$ in Rule 2, is rejected in Favour of the Workmen.

E X A M P L E.

19. There is a Brick Wall 470 Feet round, and $9\frac{1}{2}$ Feet high, and three Bricks thick, how many Rods doth it contain?
20. A Gentleman built a Wall round his Garden, which is 840 Feet, and 9 Feet high, and $2\frac{1}{2}$ Bricks thick; how many Rods doth it contain, and what will it come to at 4*l.* 19*s.* 6*d.* per Rod?
21. The End Wall of a House is $24\frac{1}{2}$ Feet in Breadth, and 40 Feet to the Roof; $\frac{1}{3}$ of which is two Bricks thick, $\frac{1}{3}$ more $1\frac{1}{2}$ Brick thick, and the Rest 1 Brick thick: Now the Gable rises 38 Course of Bricks (4 of which usually make a Foot in Depth) and this is but 4 Inches, or half a Brick thick: What will this Piece of Work come to, at 5*l.* 10*s.* Statute Rod?

68. MENSURATION of SOLIDS.

P R O B L E M XIII.

To find the Solidity of a Cube, Prism, or Right Cylinder,

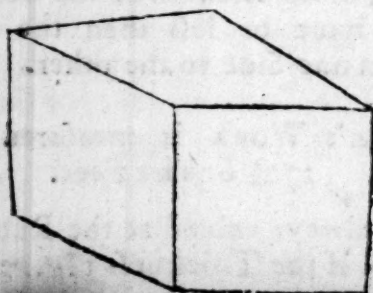


Fig. 12.

Fig. 13.

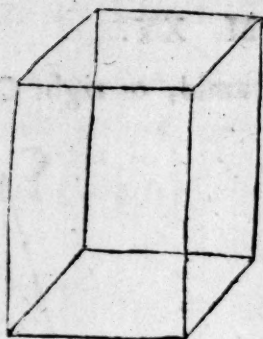
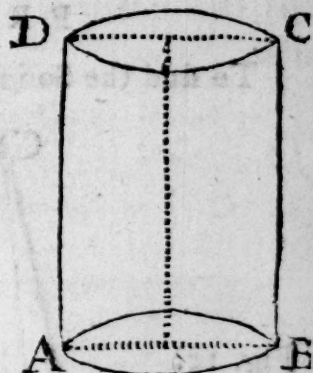


Fig. 14.



R U L E.

Multiply the Area of the Base into the Height or Altitude, and the Product will be the Solidity.

E X A M P L E S.

1. What is the solid Content of a Cube, whose Side is $2\frac{1}{2}$ Feet?
2. How many Ale Gallons of Water will a Cistern hold, whose Length, Breadth, and Depth, are 4 Feet 9 Inches, 3 Feet 6 Inches, and 2 Feet 10 Inches?
3. What is the Content of a Cylinder, whose Diameter is $4\frac{1}{2}$ Feet, and 8 Feet high?

P R O B L E M XIV.

To find the convex Surface of a Prism or a right Cylinder.

A G E N E R A L R U L E.

Find the Area of each Side and End separately, then add those Areas together, and their Sum will be the whole Surface of any Prism or Body whatever.

A P A R T I C U L A R R U L E.

Multiply the Circumference of the Base by the Altitude of the Cylinder, and the Product will give the convex Surface.

E X A M P L E.

4. What is the convex Surface of a right Cylinder, whose Circumference is $10\frac{1}{2}$ Feet, and Height $7\frac{1}{4}$ Feet.

P R O B L E M X V.

To find the Solidity of a Pyramid, or right Cone.

Fig. 15.

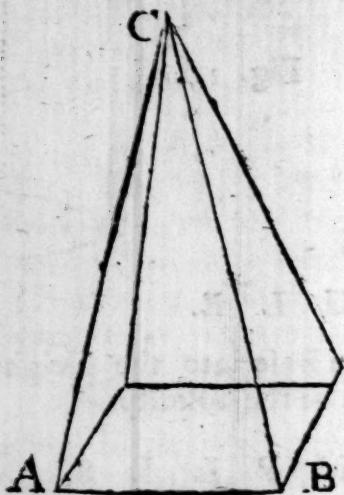
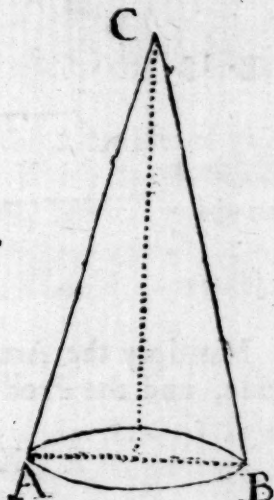


Fig. 16.



R U L E.

Multiply the Area of the Base by a third Part of the Altitude, and the Product will be the Content required.

E X A M P L E S.

5. Required the Solidity of a square Pyramid, each Side of whose Base is 12 Feet, and the slant Height 25 Feet?
6. What is the solid Content of a triangular Pyramid, whose Height is 30 Feet, and each Side of its Base $5\frac{1}{2}$?
7. What is the Solidity of a Cone, whose Base is $3\frac{1}{2}$ Feet Diameter, and Altitude 6 Feet?

P R O B L E M X V I.

To find the convex Surface of a Pyramid, or Cone, (as Fig. 15, and 16.)

R U L E.

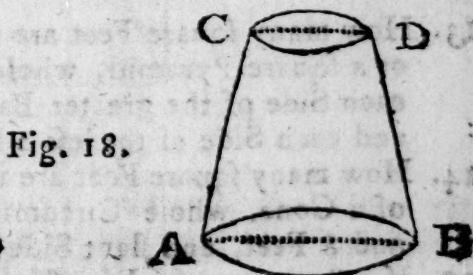
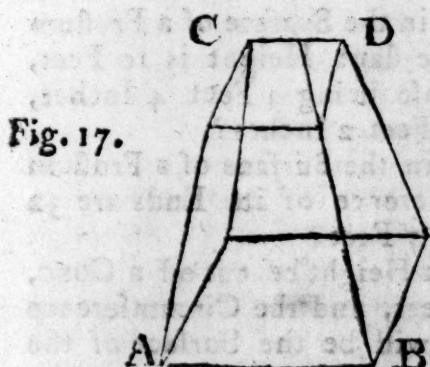
Multiply the Perimeter or Circumference of the Base by the slant Height or Length of the Side (A C) and Half the Product will be the Area.

E X A M P L E S.

8. What is the Surface of a triangular Pyramid, including the Base, the slant Height being 20 Feet, and each Side of the Base $3\frac{1}{4}$?
9. What is the convex Surface of a right Cone, whose Base is 45 Feet in Circumference, and slant Side is 20 Feet in Length?

P R O B L E M XVII.

To find the Solidity of a Frustum of a Pyramid or Cone.



Add into one Sum the Areas of the two Ends, and the mean Proportional between them; multiply the Sum by the perpendicular Height, and $\frac{1}{3}$ of the Product will be the Solidity; that is, if A be the Area of the greater End, and a of the lesser, and b the Height.

$$\text{Then } A + a + \sqrt{Aa} \times \frac{1}{3}b = \text{the Solidity.}$$

E X A M P L E S.

10. How many solid Feet are there in a Tree, whose Bases are Squares, each Side of the one being 15 Inches, and each Side of the other 6, and the Length measures along the Side 24 Feet?
11. What is the Content of the Frustum of a Cone 60 Feet high, the Diameter of its Ends being 20 and 3 Feet?
12. How many solid Feet are there in a Conical Frustum, the Circumferences of whose Bases are 66 and 56 Feet, Height is 4 Feet?

P R O B L E M XVIII.

To find the convex Surface of the Frustum of a Pyramid or right Cone.

R U L E.

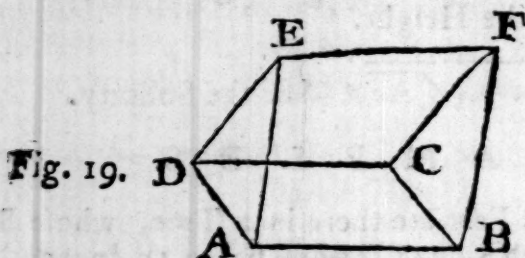
Multiply the Sum of the Perimeters or Circumference of the Ends, by the slant Height, and Half the Product will be the Surface required.

E X A M P L E S.

13. How many square Feet are in the Surface of a Frustum or a square Pyramid, whose slant Height is 10 Feet, each Side of the greater Base being 3 Feet 4 Inches, and each Side of the less 2 Feet 2 Inches?
14. How many square Feet are in the Surface of a Frustum of a Cone, whose Circumference of its Ends are 32 and 8 Feet, and slant Side 7 Feet?
15. If a Segment of 6 Feet slant Height be cut off a Cone, whose slant Height is 30 Feet, and the Circumference of its Base 10 Feet, what will be the Surface of the Frustum?

P R O B L E M XIX.

To find the Solidity of a Cuneus or Wedge.



R U L E.

Multiply the Area of the Base, ADE, or BCF, by Half the Altitude DC, of the Wedge, and the Product will give the Solidity.

$$\text{Thus, } AD \times DE \times \frac{CD}{2} = \text{the Solidity.}$$

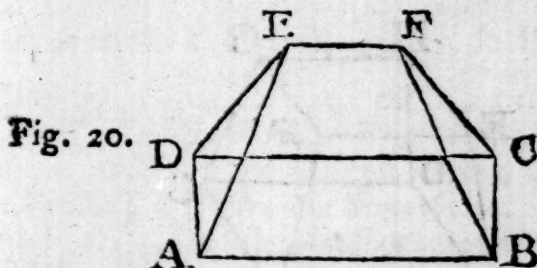
E X.

E X A M P L E.

16. What is the Solidity of a Wedge, whose Base measures 30 Feet by 16, and whose Height is 12.

P R O B L E M XX.

To find the Solidity of a Pavilion Roof.



R U L E.

To the Length of the Ridge, add twice the Side of the Base, which is parallel to it: Multiply the Sum by the other Side of the Base, and the Product which arises by a sixth Part of the Altitude, and the second Product will give the Solidity.

$$\text{Thus, } \overline{EF + 2AB} \times \overline{BC} \times \frac{\text{alt.}}{6}.$$

E X A M P L E.

17. What is the Solidity of a Pavilion Roof, whose Base is 36 by 20, Ridge parallel to the greatest Side 16, and Altitude 12 Feet?

P R O B L E M XXI.

To find the Solidity of the Frustum of a square Pyramid, made by a Section parallel to the Base.

R U L E.

To the Areas of the Ends add the Product of their Sides, multiply the Sum by a third Part of the Altitude, and the Product will give the Solidity.

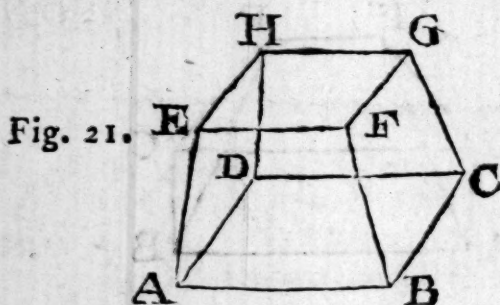
E X.

E X A M P L E.

18. What is the Solidity of the Frustum of a Pyramid 60 Feet high, whose Ends are 16 and 13 Feet square.

P R O B L E M XXII.

To find the Solidity of a Prismoid.



R U L E.

To the Area of the Ends, add the Product of the Sums of the Lengths and Breadths; multiply this Sum by a sixth Part of the Altitude, and the Product will give the Solidity.

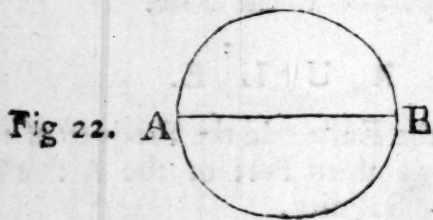
Thus, $AB \times BC + EF \times FG + \frac{AB + EF \times BC + FG + \text{alt.}}{6}$

E X A M P L E.

19. What is the solid Content of a Canal 304 Feet by 20 at Top, 300 Feet by 16 at Bottom, and 5 Feet deep?

P R O B L E M XXIII.

To find the Surface of a Sphere or Globe, or of any Segment or Zone of it.



A GENERAL RULE.

Multiply the Circumference of the Sphere into the Diameter or Height of the Part required, and the Product will be the curve Surface, whether it be Segment, Zone, Hemisphere, or the whole Sphere.

Note. The Height of the whole Sphere is its Diameter.

PARTICULAR RULES.

1. Find the Circumference of a great Circle upon the Globe, by Prob. VI. Rule I. or by multiplying the Radius by 6,2832, multiply the Circumference by the Diameter, and the Product will give the Superficies. Or,
2. Multiply 3,1416 by the Square of the Diameter, and the Product will give the Superficies.

EXAMPLES.

20. What is the Surface of a Globe, whose Diameter is 7?
21. What is the Surface of a Globe, whose Semi-Diameter is 6 Inches?
22. If the Diameter or Axis of the Earth be 7957 $\frac{1}{2}$ Miles. what is the whole Surface, supposing it a perfect Sphere?
23. What is the Superficies of a Segment 9 Feet high, cut from a Globe of 42 Feet Diameter?

PROBLEM XXIV.

To find the Solidity or Content of a Sphere or Globe.
(See Fig. to Prob. XXIII.)

RULES.

1. Find the Superficies by the last Problem, multiply the Superficies by $\frac{1}{2}$ of the Radius, or by $\frac{1}{4}$ of the Diameter, and the Product will be the Solidity: Or,
2. Multiply the Cube of the Diameter by ,5236, and the Product will give the Solidity; that is,

$$\frac{3,1416}{6} = ,5236, \text{ the Solidity: Or,}$$

3. Find the Content of a circumscribing Cylinder, by
† R Problem

Problem XIII. and take $\frac{2}{3}$ of it for the Content of the Globe.

For a Globe is $\frac{2}{3}$ of its circumscribing Cylinder, and ,5236 is the Content of a Globe whose Diameter is 1.

E X A M P L E S.

24. What is the Content of a Globe whose Diameter is 7?
 25. Suppose the Earth to be spherical, and its Diameter 7957 $\frac{1}{2}$ Miles, what is its Solidity?

P R O B L E M XXV.

To find the Solidity of the Segment of a Globe. (See fig. 23.)

R U L E S.

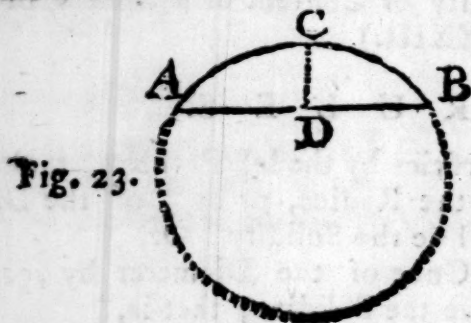
1. From three Times the Diameter of the Globe, take twice the Altitude of Segment; multiply together the Remainder, the Square of the Altitude, and ,5236, and this Product will give the Solidity.

Thus, let $b = CD$ the Height of the Segment, and d the Diameter.

Then, $3d - 2b \times ,5236 \times bb =$ the Solidity of ACB.

2. To three Times the Square of the Radius of its Base, add the Square of its Height; multiply the Sum by the Height, and that Product again by ,5236, will give the Solidity.

That is, if $r = AD$, the Radius of its Base, $b = CD$, the Height. Then $,5236b \times 3rr \times bb =$ the Solidity of the Segment ABC.



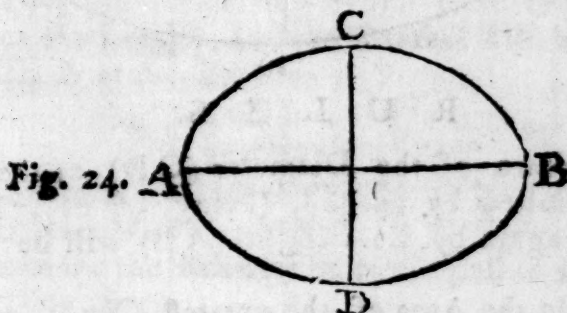
E X A M P L E.

26. What is the Solidity of a Segment 4 Feet high, cut from a Globe 18 Feet Diameter.

P R O.

PROBLEM XXVI.

To find the Solid Content of a Spheroid.



R U L E I.

Multiply continually together the fixed Axis, the Square of the revolving Axis, and the Number ,5236, (being $\frac{1}{6}$ of 3,14159 nearly) and the last Product will be the Content required; that is, if $p=3,14159$, &c. r = the Transverse, and c = the conjugate Axis of the generating Ellipse.

Then $\frac{1}{6} p r r c$ = the oblate,
And $\frac{1}{6} p c c r$ = the oblong Spheroid.

R U L E II.

Multiply the Area of the generating Ellipse by $\frac{2}{3}$ of the revolving Axis, and the Product will be the Content of the Spheroid.

Let A = the Area of the Ellipse, then from the former Rule,

$\frac{2}{3} r A$ = the Oblate,
And $\frac{2}{3} c A$ = the oblong Spheroid.

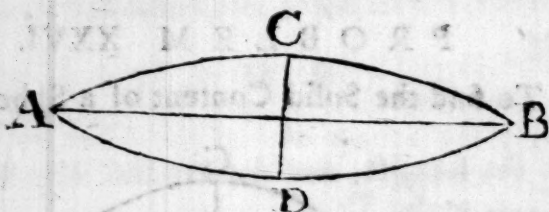
E X A M P L E.

27. What is the solid Content of a Spheroid, whose Diameter of the greatest Circle is 33 Inches, and the Length 55 Inches?

PROBLEM XXVII.

To find the Solidity of a Parabolic Spindle.

Fig. 25.



R U L E S.

1. The Square of the Diameter (CD) of the greatest Circle, multiplied by ,41888, (being $\frac{8}{15}$ of ,7854) and that Product again by its Length (AB) will be the Solidity.

2. Multiply the Area of the greatest Circle, or middle Section, by the Length, and $\frac{8}{15}$ of the Product will be the Content.

That is, if AB = the Length or Axis DE = the greatest Diameter, or double the Abscissa of the generating Parabola ACB, and $n = ,785398$, or ,7854. Then $\frac{8}{15}n \times DC^2 \times AB =$ the whole Solid. A D B C A.

E X A M P L E.

28. What is the Solidity of a Parabolic Spindle, whose greatest Diameter is 36, and its Length 99 Inches?

P R O B L E M XXVIII.

To measure TIMBER.

A square Piece of Timber, equally thick at both Ends, is a Prism; a round Piece, equally thick at both Ends, is a Cylinder; a square Piece, that tapers regularly, is the Frustum of a Pyramid; and a round Piece, that tapers, regularly, is the Frustum of a Cone: and the Contents of these Solids may be exactly computed by their respective Rules.

But because the Mensuration of tapering Timber by the exact Rules is troublesome, an Approximation has taken Place, and the Contents of such Trees are generally computed by the following

R U L E.

Multiply the Square of the Quarter Girt (or $\frac{1}{4}$ of the Circumference) in Inches, by the Length in Feet, divide the Product by 144, and the Quotient will be the Content in Feet.

But

But to find the Content more near the Truth, observe the following

R U L E.

Multiply the Square of $\frac{1}{2}$ of the Girt or Circumference by twice the Length, and the Product will be the Content, extremely near the Truth.

R E M A R K S.

1. The Girt of a Piece of Timber is its Compass or Circumference at the Middle, $\frac{1}{2}$ of which is commonly taken for the Side of a Square, equal to the Area of the Section there.
2. Trees of regular Growth must be measured in Parts or Pieces, as above directed.
3. Allowance must be made for the Thickness of Bark (if on the Tree) in Oak $\frac{1}{10}$ or $\frac{1}{12}$, in other Wood not so much.
5. When the Timber is to be reduced to Loads.

Divide the Feet in $\left\{ \begin{array}{l} \text{rough} \\ \text{hewn.} \end{array} \right\}$ by $\left\{ \begin{array}{l} 40 \\ 50 \end{array} \right\}$ gives the Load.
As 40 Feet make one Load of rough Timber, and 50 one of hewn.

E X A M P L E S.

29. What is the Content of a Tree, whose Girt is 42 Inches, and Length 16 Feet?
30. What is the Content of a Tree, whose Compass is 64 Inches, and the Length 30 $\frac{1}{2}$ Feet?
31. How many Loads of Timber are there in a hewn Tree, whose Breadth is 42 Inches, Depth 30 Inches, and Length 40 Feet?

G A U G I N G.

P R O B L E M XXIX.

To find the Area of any Triangular, Tun, Back, Cooler, or circular and elliptical Superficies in Ale Gallons, &c.

R U L E S.

1. Find the Area in Inches by the different Problems in Sect. 75, and the Solidity by Sect. 76, then,

Divide by $\left\{ \begin{array}{l} 282 \\ 231 \\ 268.8 \end{array} \right\}$ for $\left\{ \begin{array}{l} \text{Ale.} \\ \text{Wine.} \\ \text{Corn.} \end{array} \right.$

and the Quotient will be the Area in Gallons. Or,

2. If the Square of the Diameter of any Circle.

Divide by $\left\{ \begin{array}{l} 359.05 \\ 294.12 \\ 342.24 \end{array} \right\}$ for $\left\{ \begin{array}{l} \text{Ale Gallon.} \\ \text{Wine Gallon.} \\ \text{Corn Gallon.} \end{array} \right.$

the Quotient will be the Area in their reſpective Gallons.

For as, $785398 : 1 :: 282$, the Square of the Diameter of the Circle, whoſe Area is 282 cubic Inches, viz. one Ale Gallon, and from this Proportion ariſes the preceding Diviſions:

$$\text{Viz. } \left\{ \begin{array}{l} 282 \\ 231 \\ 268.8 \end{array} \right\} \div 785398 = \left\{ \begin{array}{l} 359.05. \\ 294.12. \\ 342.24. \end{array} \right.$$

Or, theſe Diviſors may be turned into Multipliers, by dividing Unity or 1, or rather, by dividing the Area in Inches of that Circle, whoſe Diameter is 1.

That is, 785398 , by 282 , &c.

$$\text{Thus, } 785398 \div \left\{ \begin{array}{l} 282 = .002785. \\ 231 = .003399. \\ 268.8 = .002922. \end{array} \right.$$

The Product will be the Area in Gallons of the ſame Name.

E X A M P L E S.

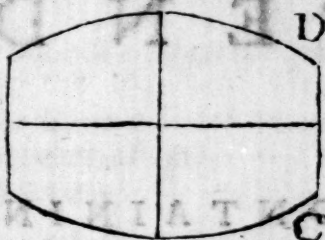
32. Suppose the Length of a Brewer's Tun, Back or Cooler, be 16 Feet 6 Inches, and its Breadth 7 Feet 4 Inches, what will be the Area in Ale or Beer Gallons, &c.?
33. The Length of the Baſe of a Triangular Cooler is 94 Inches, and its perpendicular Breadth is 58 Feet 6 Inches: Required its Area in Ale Gallons?
34. Suppose the longeſt Diameter of a Brewer's Veſſel be 84.5 Inches, and the ſhorteſt Diameter to be 50 Inches, what will be the Area in Ale Gallons?
35. Suppose a Tun in the Form of the Fruſtum of a Pyramid, whoſe Baſes are equilateral Triangles, let the Side of the Top be 64 Inches, the Side of the Bottom be 68.6 Inches, and its Height or Depth 36 Inches, what is the Content of that Tun in Ale Gallons, &c.?
36. If the Diameter of the Baſe of a regular Cone, is 60.5 Inches,

Inches, and the perpendicular Height is 42.8 Inches, what will be the Content in Ale Gallons, &c.?

37. Suppose the Diameter of a Frustum of a Cone be 84 Inches at the Top, and the Diameter at the Bottom to be 62 Inches, and the Height 42 Inches, required the Content in Ale Gallons?

The Bung Diameter EF, Head Diameter CD, and Length of the Cask AB (within Side) being given; to find the Content of a Cylinder nearly equal to it.

Fig. 26.



R U L E S.

1. To twice the Area of the Circle at the Bung, add the Area of the Circle of the Head, multiply the Sum by one-third of the Length of the Cask, the Product is the Content in Cubic Inches, which are converted into Gallons, by dividing by 282 for Ale, and 231 for Wine Gallons: Or,

2. To the Square of the Head Diameter, add twice that of the Bung Diameter, and from that Sum take $\frac{2}{3}$ of the Square of the Difference of the said Diameters; then multiply the Remainder by the Length of the Cask; then if the Product be multiplied

by $\left\{ \begin{array}{l} .00092837 = .002785 \\ .00113333 = .003399 \end{array} \right\} \div 3$, will give the Area.

Or divided $\left\{ \begin{array}{l} 1077.15 = 359.05 \\ 882.36 = 294.12 \end{array} \right\} \times 3$, will give the Area.

E X A M P L E S.

38. What is the Content of a Cask, whose Bung Diameter, Head Diameter, and Length is 32, 26, and 40 Inches, within Side respectively?
39. Suppose the Bung Diameter of a Cask to be 40 Inches, Head 36, and Length 64, required the Content both in Ale and Wine Gallons?

A P P E N D I X.

A P P E N D I X.

C O N T A I N I N G

Various Forms of Acquittances, Promissory Notes, Bills of Exchange, Letters of Advice, Letters of Credit, Bills of Parcels, and Bills on Book Debts, all of which are adapted to such Circumstances as occur in real Business, to enter a Pupil in the Manner and Method of Commerce, and to make him ready at Computation.

A general Receipt.

R ECEIVED August 9th, 1784, of Mr. Anthony Buskin the Sum of Fifty Pounds, in full for one Quarter's Rent, due at Midsummer last, and of all Demands,

By me HENRY HEDGES.

£ 50 00 00

A Receipt or Acquittance for Rent paid.

Received this 5th Day of January, 1784, of Mr. Thomas Field, the Sum of Thirty-two Pounds Sixteen Shillings in Money, which with Eight Pounds Four Shillings more, disbursed by the said Thomas Field for Taxes and Reparations of the Messuage and Tenements he now occupies,

Stuate



situate in Chiswell-Street, London, makes in the Whole the Sum of Forty Pounds, and is in full of Half a Year's Rent due to me out of the said Premises at Michaelmas Day last.—I say received by me,

£ 40 00 00

THOMAS ROSE.

An Acquittance for Debt received of a third Hand.

RECEIVED this 10th Day of July, 1784, of Mr. Joseph Stanley, by the Hands of Mr. Clark Stanley, the Sum of Seven Pounds, in full for certain Goods bought by the said Joseph Stanley of me.—I say, received in full of all Demands, by me,

£ 7 00 00

FRANCIS CRUMME.

An Acquittance for Money received in Part of a Debt due on Bond.

RECEIVED this 16th of June, 1784, of Mr. Thomas Brown, the Sum of Ten Pounds Ten Shillings and Six Pence, in Part of Payment of a greater Sum, due to me on Bond from the said Thomas Brown.—I say, received by me,

£ 10 10 06

THOMAS HEDGES.

An Acquittance for Money received by a third Person for the Use of another.

RECEIVED this 18th Day of March, 1784, of Mr. Edward Hedges, the Sum of Twenty Pounds, in full for Work done by Charles Day, for the said Mr. Edward Hedges.—I say received by the Order, and for the Use of the said Charles Day, by

£ 20 00 00

THOMAS WOOTTON.

A Receipt for Interest due on Bond.

RECEIVED this 13th Day of January, 1784, of Mr. Abraham Brooks, the Sum of Five Pounds, in full for one Year's Interest, of 100*l.* due to me at Christmas last, on Bond from the said Abraham Brooks—I say received by me,

DAVID BURN.

£ 5 0 0

Note, Besides these Receipts to be taken on Payment of Money due on Bonds, it is proper to have each Payment mentioned on the Back of the Obligation.

An Acquittance for a Legacy.

RECEIVED this 29th Day of July, 1784, of John Roberts, Executor of the last Will and Testament of Samuel Green, late of Westham, in the County of Essex, deceased, the Sum of One Hundred Pounds, in full of a Legacy bequeathed to me, in and by the last Will and Testament of the said Samuel Green—I say received in full of all Demands by me,

JOHN JARRETT.

£ 100 0 0

An Acquittance to an Administrator on Payment of a Debt due from the Intestate.

RECEIVED this 30th Day of July 1784, of Mr. Wm. Jarrett, Administrator of the Goods and Chattels, Rights, and Credits of John Noon, late of Bristol, in the County of Somerset, deceased, the Sum of Three Hundred Pounds, in full of a Debt owing me by the said John Noon in his Life-time, for Household Goods by me sold him.——I say received in full of all Demands by me,

£ 300 00 00

GEORGE CHINNER.

A Receipt proper to be taken upon a Person's giving a Promissory Note for a Book Debt.

RECEIVED this 20th Day of April, 1784, of Mr. William Straight, a Promissory Note for the Sum of Sixty Pounds, payable to me or Order three Months after Date, which Sum when paid is in full of all Demands.——I say received by me,

£ 60 00 00

THOMAS ROSS.

An Acquittance for the Purchase-Money on executing of a Conveyance, to be indorsed on the Back of a Deed.

RECEIVED the Day and Year within written, of the within named Thomas Biffon, the Sum of Seventy Pounds, being the full Consideration Money within mentioned to be paid to me.——I say received by me,

£ 70 00 00

CHARLES BARRON.

Witness to the Payment
of the Money. }

A Receipt

A Receipt for Writings entrusted in a Person's Hands.

RECEIVED this 25th Day of November 1784, of John Stag, of Eye, in the County of Suffolk, four several Deeds of Conveyances; one of them purporting to be a Lease of a Messuage, situate in Narrow-Street, Lime-House, and made between John Lee of Wapping, and William Burt, of Westminster, another to be an Assignment of the said Lease, and made between John Vyse of New-street, London, and Felix Morgan, of Bangor, in the County of Carnarvon; and the other to be a Lease and Release, and made between John Jee, of Barking, in the County of Essex, and John Bevan, of Newhaven, in the County of Sussex; for which several Deeds or Writings, I hereby promise to be accountable, and to re-deliver the same to the said John Stag on Demand.

HENRY WRIGHT.

Witness my Hand,

*The Form of Promissory Notes, or common Notes for Money.**The Form of one payable on Demand.*

I PROMISE to pay to Anthony Wilson or Order, the Sum of Twenty Pounds on Demand, for Value received. Witness my Hand this first Day of January 1784.

HENRY WILSON.

£ 20 00 00

The Form of one Payable at a certain Time.

London, January 4, 1784.

THREE Months after Date, I promise to pay to Mr. Aaron Brooks or Order, the Sum of Ten Pounds, for Value received by me,

CHARLES VYSE.

£ 10 00 00

Form

Form of one payable at sundry Times.

I PROMISE to pay Sir Aaron Day or Order, the Sum of Thirty-six Pounds, in the Manner following: Ten Pounds, Part thereof, three Months after Date, Sixteen Pounds more the 20th of May next, and the remaining Ten Pounds the 27th of July next following, for Value received. Witness my Hand at London, the 2d of January 1784.

JOHN COWCHEE.

£ 36 00 00

Form of one for Goods received.

I PROMISE to return John Whyley, Esq. or Order, on Demand, one Casket of Jewels, sealed, One Hundred Ounces of Gold Plate, Three Hundred and Fifty of Silver ditto, One Hundred Carats of Oriental Pearl, and a Five Hundred Pound Bank Note. — Received of the said John Whyley, Esq. for Self and Company, March 4, 1784, by me,

JAMES COWCHEE.

*Forms of Inland Bills of Exchange.**Form of one payable at Sight.*

£ 100

Bristol, January 14, 1784.

AT Sight pay Mr. John Barwick or Order, the Sum of One Hundred Pounds, the Value received of Mr. James Barwick, and place it to Account as per Advice from

WM. BARWICK.

To Mr. Charles Davis, at the
 Horse-guards, Whitehall, London. }

Form of one Payable after Sight.£ 64 17 6

London, June 12, 1784.

AT Ten Days Sight pay Mr. William Straight, or Order, the Sum of Sixty-four Pounds, Seventeen Shillings and Six Pence, for Value received, of Thomas Johnson, Esq. and place it to Account as per Advice from

GEORGE DEAR.

To Mr. Thomas Lawr, }
Clothier, Salisbury. }

Form of one payable after Date.£ 70

Edinburgh, July 2, 1784.

THREE Months after Date pay Sir John Walker, or Order, the Sum of Seventy Pounds, Sterling, Value in Ourselves, and place it without more Advice to the Account of

THOMAS and JAMES BURN.

To Sir Tho. Biffon, }
Lombard-street, London. }

£ 40

London, Nov. 24, 1784.

Messrs. Fox and Payn,

PAY Thomas Stanley or Bearer, Forty Pounds on Account.

THOMAS PETTIT.

Another

Another.

S I R,

York, June 4, 1784.

PAY Mr. Thomas Ross, or Bearer, One Hundred Pounds,
on Demand, and place it to my Account.

THO. CLIFFORD.

To Mr. John Hawkins, }
Silversmith, Whitechapel. }

*Form of Foreign Bills of Exchange.**For Crowns 600 at Usance.*

London, July 12, 1784.

London } At Usance pay this First of Exchange to
on Paris. } Henry Gibbins or Order, Six Hundred Crowns
First Bill. } for the Value here received of Samuel Drum-
mond, and place it to Account, as per Ad-
vice from

To Mr. George Pain, }
Merchant, at Paris. }

JOHN PLAW.

For Crowns 600 at Usance.

London, July 12, 1784.

Second } AT Usance pay this my Second of Exchange,
Bill. } my First not paid, to Joseph Lindman or Or-
der, Six Hundred Crowns for the Value received
of Sir George Wayer, and place it to Account,
as per Advice from

THOMAS SWIFT.

To Mr. Robert Clifford, }
Merchant at Paris. }

£602 15s. 3 $\frac{1}{4}$ Sterl. at 34d $\frac{1}{4}$.
per £. Sterl. Usance.

London, Sept. 6, 1784.

London on
 Rotterdam.
 First Bill.

AT Usance pay this First of Exchange to
 James Vyse or Order, Six Hundred and
 Two Pounds Fifteen Shillings and Three
 Pence One Farthing Sterl. at Thirty-four
 Pence One Farthing Flem. per Pound Sterl.
 Value of Samuel Turner, Esq. and place
 it as per Advice from

Your most humble Servant,

THOMAS WOOLDRIDGE.

To Mr. Samuel Cook, Mer- }
 chant, at Rotterdam.

Form of a Factor's Remittance to his Employer.

For Crowns, 700 at 5s. 4d. Sterl.

Genoa, Sept. 6, 1784.

AT Twenty Days Sight pay this my First of Exchange
 to Thomas Godfrey or Order, Seven Hundred Crowns Ex-
 change, at Fifty-four Pence per Crown, Value received of
 the Lords of the Regency, and place it to the Account of
 Mr. Wm. Stanes, of Lyons, as per Advice from him,

GEORGE WARD.

To Mr. Francis Baker, Banker, }
 Lombard-street London.

*Mr. William Stanes's Letter, advising his Concurrence to the
 afore mentioned Draught.*

S I R,

Lyons, Sept. 30, 1784.

BROTHER George Ward, of Genoa, has this Day de-
 fired me to furnish him with Seven Hundred Crowns, pay-
 able

able to the Resident of the States at London. I have therefore ordered him to draw for the said Sum on you, which please to honour as usual, and put it to the Account of

Your Friend and Servant,

WILLIAM STANES.

To Mr. Francis Baker, Banker, }
Lombard-street, London. }

*Form of a Draught on the Employer for Value of Goods
shipped him per Factor.*

Milrees 400 at Usance

St. Andrews, June 24, 1784.

North Britain }
on Lisbon. }

AT Usance pay this my first of Exchange to Mr. Edward Ross or Order, Four Hundred Milrees, the Value here shipped for your Use, upon the Santa Maria of Naples, and consigned as per Advice from your very humble Servant,

MICHAEL GODFREY.

To Signior Santilena, }
at Lisbon. }

*Form of an Employer's Letter with Remittance to his Factor, in
a Bill of the said Factor's Correspondent.*

Mr. Thomas Dale,

ACCORDING to your Desire I have remitted you Four Hundred Crowns for my Accompt, in your Correspondent Baker's Bill inclosed, payable by and to yourself, for which please to give me Credit: I recommend the Contents of my last and the 4th Current to you, and rest your Friend and humble Servant,

EDWARD BAKER.

Paris, Sept. 14, 1784.

For Crowns 400, at 34d. per Crown.

Paris, Sept. 14, 1784.

The Bill. } AT double Ufance pay this my only Bill of
Exchange to myself, the Sum of Four Hun-
dred Crowns, Exchange at Thirty-four Pence,
Sterl. per Crown, the Value received of
Mons. Edward Baker, and place it as per
Advice to the Accompt of

Your humble Servant,

HENRY VYSE

To Thomas Day, Mer- }
chant, at Bristol. }

Form of the Correspondent's Letter of Advice.

Mr. Thomas Day,

S I R,

Paris, Sept. 14, 1784.

By this Post I have drawn on you for Four Hundred Crowns, at 34d. payable to yourself, Value of Mons. Edw. Bakerman, which with my other Bills depending please to honour, and the timely Remittance shall be punctually made you by

S I R,

Your very humble Servant,

NICHOLAS BROWN.

To Mr. Timothy Bevan, }
Merchant, Bristol. }

Form of Letters of Credit.

S I R,

London, June 12, 1784.

PLEASE to furnish the Bearer hereof, Mr. Thomas Cavendish, with the Sum of one Hundred Pounds, as he shall require the same, and place it to my Account, for which this Letter of Credit, with his Receipt, shall be your sufficient Voucher and Warrant, giving upon Payment a Line or two of Advice to

Your real Friend,

FRANCIS ROSS.

To Mr. John Day, Mer. }
chant, at Hull. }

The Receipt.

RECEIVED July 6, 1784, of Mr. Robert Berry, the Sum of One Hundred Pounds, by Virtue of Mr. Francis Ross's Letter of Credit of June 12th last, for the said Sum, per

MICHAEL NICHOLS.

£.100 0 0

S I R,

Dublin, May 7, 1784.

THE Bearer, Mr. Thomas Vyse, will have occasion for Sixty Pounds, which Sum I desire you to furnish him, and take his Bill for the said Sum, or any Part thereof, on the Honourable William Webb, Esq.

I am, Sir,

Your humble Servant,

RICHARD KIRK.

To Henry Hedges, Esq. }
Fleet-street, London. }

Exch.

Exch. £ 70

S I R,

June, 4, 1784.

The } AT Twelve Days Sight pay this my First of Ex-
 Bill. } change to Henry Hopkins, Esq. or Order, the
 Sum of Seventy Pounds, the Value received of
 Ditto for your Use, as per Advice from, Sir,

Your humble Servant,

THOMAS VILE.

To the Hon. Wm. }
 Bay, Esq. Dublin. }

Exch. £ 70.

S I R,

June 4, 1784.

AT Twelve Days Sight pay this my Second of Exchange,
 my first not paid, to Richard Kirk, Esq. or Order, the Sum
 of Seventy Pounds, the Value received for your Use, of
 Henry Hopkins, Esq. as by Advice from

Your humble Servant,

THOMAS WILKS.

To the Hon. William }
 Bay, Esq. Dublin. }

*Form of a general Letter of Credit, to furnish a Person ac-
 cording to his Occasion.*

S I R,

Paris, May 12, 1784.

THE Bearer, Mr. Aaron Babel, one of his Britannic
 Majesty's Messengers, being ordered to Constantinople, will
 have Occasion for Money to defray his Charges, &c. Please
 to furnish him with the Sums he shall require at the said
 Place, taking his Receipts, and your Draught for the Value
 shall receive due Honour from

Your humble Servant,

MICHAEL WELLS.

Monf. Carter Day, }
 Banquier, a Vienna. }

For

For 600 at Flor. 3l. 4s.

S I R,

Vienna, June 2, 1784.

AT Three Days Sight pay this my only Bill of Exchange, to Edward Fay or Order, the Sum of 600 Florins, Exchange at three Livres four Sols per Florin, the Value paid at Constantinople to Aaron Babel, pursuant to your Letter of Credit of the 12th of May last, and as by Advice from the said Aaron Babel.

RICHARD STANES.

A Monf. Henry Hedges, }
Banquier, a Paris }

Bills of Parcels, and Book Debts.

(1). Mr. A. B.

Bought of THOMAS GROCER, Jan. 2, 1784.

	s.	d.	£.
4lb. of Green Tea, — at	17	6	per lb.
12lb. of Bohea, —	7	10 $\frac{3}{4}$	—
5 Hundred of Tobacco,	66	0	per C.
10 Barrels of Raisins,	46	4	per B.
9lb. of Pepper, —	2	9	per lb.
7lb. of Brimstone, —	1	8 $\frac{1}{2}$	—
8lb. of Coffee, —	12	9	—
77oz. of Mace, —	1	6 $\frac{1}{2}$	—

£.

(2) Mrs.

(2) Mrs. T. G.

Bought of THOMAS SILK-MERCER, Jan. 7, 1784.

		s.	d.	£.	s.	d.
20 Yards of Brocaded Sattin, at	17	9	per Yd.			
36 Yards of Mohair, —	10	8				
86 Ditto of Green Silk Damask, 19	11	$\frac{1}{2}$				
100 Ditto of Paduasoy, —	11	10				
9 Ditto of double Taffaty, —	3	9				
12 Yards of ditto —	5	6				
6 Yards of ditto —	9	11	$\frac{1}{2}$			
42 Yards of ditto —	10	6				

 £.

(3.) The Hon. Lady B.

Bought of J. LINEN-DRAPER, Jan. 6, 1784.

		s.	d.	£.	s.	d.
80 Ells of Dowlas, at	0	11	$\frac{3}{4}$ per Y.			
96 Ells of Holland, —	5	7	$\frac{1}{2}$			
19 $\frac{1}{2}$ Ells of Diaper, —	1	7				
27 $\frac{1}{4}$ Yards of Damask, —	4	10	$\frac{1}{4}$			
12 Yards of Muffin, —	11	0				
24 $\frac{1}{2}$ Ells of Cambric, —	5	6				

 £.

(4.) Madam B.

Bought of B. MILLINER, Jan. 4, 1784.

		s.	d.	£.	s.	d.
26 $\frac{1}{2}$ Yards of blue Ribbon, at	2	6	per Yd.			
12 Fans, French Paper Mount, 4	9	each.				
6 Pair of Roman Gloves, 9	6	per Pr.				
4 Dozen of Irish Lamb ditto 1	10	$\frac{1}{2}$				
6 Sarfnet Hoods, white, 5	11	each.				
A Piece of Mechlin Lace, 12 $\frac{3}{4}$ Y. 17	6	per Yd.				

 £.

(5.) Mrs. F. PINDUST,

Bought of THOMAS HOSIER, July 12, 1784.

	s.	d.		£.	s.	d.
28 Pair of Thread Stockings, at	4	6	per Pr.			
1 $\frac{1}{2}$ Dozen of Worsted, mixt,	3	10				
18 Pair of Strawberry Hose,	4	0				
16 Pair of Silk Gloves,	5	11 $\frac{1}{2}$				
74 Pair of Norwich Hose,	2	6				
17 Pair of Mens Yarn,	—	3	0			
11 $\frac{1}{2}$ Dozen ditto, Silk,	—	16	6			

£.

(6.) Mrs. ANN SCOTT,

Bought of JOHN FRUITERER, May 7, 1784.

	s.	d.		£.	s.	d.
6 Dozen of Lemons, at	2	10	per Doz.			
4 $\frac{1}{2}$ Hundred of Lisbon ditto,	6	6	per Hun.			
10 Ropes of Onions, —	1	9	each.			
17 D. Seville and China Oranges,	4	6	per Doz.			
A Bushel of Chesnuts, —	—	—			10	6
6 Dozen of Pomegranates,	4	10				

£.

(7.) Mr. C. TOMS,

Bought of Mr. JAMES DRAPER, Feb. 4, 1784.

	s.	d.		£.	s.	d.
12 $\frac{7}{8}$ Yards of Broad Cloth, at	18	6	per Yd.			
17 Yards of fine Spanish Black	17	4				
14 $\frac{5}{8}$ Yards of fine Grey Cloth,	16	10				
6 $\frac{1}{2}$ Yards of second Drab,	12	8				
27 $\frac{3}{4}$ Yards of Shalloons, —	1	9				
19 Yards of Serge, —	4	10 $\frac{1}{2}$				

£.

8.) Mr. W. L.

Bought of ANDREW OILMAN, March 7, 1784.

		s.	d.		£.	s.	d.
12lb. of Anchovies,	at	1	6	per lb.			
6½lb. of Capers,	—	0	11½				
26lb. of Salt,	—	0	9¼				
4 Gallons of pickled Mushrooms,	3	6		per gal.			
3 Gallons of Lucca Oil,	—	10	6				
12lb. of Salt-Petre,	—	1	4¼	per lb.			
					£.		

(9.) JOHN JONES, Esq.

Bought of THO. CHEESEMONGER, Jan. 16, 1784.

		C. gr. lb.	s.	d.			
6 Old Cheshire Cheeses, Wt.	3	2	14	at	44	6	per C.
4 Gloucestershire ditto	2	3	21		36	4	
8 Flitches of Bacon,	—	50	Stone	—	2	11¼	per St.
10 Firkins of Butter,	—				32	6	each.
24 Stilton Cheeses,	—	6	2	9	37	10	per C.
3 Weyes of Suffolk Butter,	—				132	6	each.
					£.		

(10.) SIR MATTHEW LAMB,

Bought of NATH. WINE-MERCHANT, Oct. 4, 1784.

		s.	d.		£.	s.	d.
12½ Dozen of Claret Wine, at	37	6		per Doz.			
4 Gallons of Canary,	9	6		per Gal.			
2 Hhds of old Mountain,	6	4					
26 Dozen of Madeira,	30	6		per Doz.			
12 Dozen of Tent,	59	10					
4½ Dozen of Red Port,	19	10					
					£.		

(11.) Mrs.

(11.) Mrs. B.

1784.

Bought of J. BUTCHER,

		lb.	d.	£.	s.	d.
Jan. 2.	A fore Quar. Lamb, wt.	10 $\frac{3}{4}$	at 4 $\frac{3}{4}$	per lb.		
29.	Ditto of Pork, —	14	5	—		
Feb. 4.	A Buttock of Beef	49	4 $\frac{1}{2}$	—		
10.	A Fillet of Veal, —	11 $\frac{1}{2}$	5 $\frac{1}{4}$	—		
27.	A Surloin of Beef, —	26	4 $\frac{1}{2}$	—		
Mar. 6.	Beef Steaks, —	10	5 $\frac{3}{4}$	—		
14.	A Saddle of Mutton,	17 $\frac{1}{4}$	4 $\frac{1}{4}$	—		

£.

(12.) JOHN THOMAS,

Bought of J. CORN-CHANDLER, Mar. 4, 1784.

		s.	d.	£.	s.	d.
4	Quarters of Barley, at 16	9	per Quar.			
32	Bushels of Wheat, —	5	9	per Bush.		
	Ditto of Oates, —	11	9	per Quar.		
20	Bushels of Beans, —	4	6	per Bush.		
18lb.	of Hops, —	1	9	per lb.		
4	Loads of Hay, —	50	0	per Load.		

£.

(13.)

Sept. 6, 1784.

Mr. JONES, Dr.

To J. COAL-MERCAANT.

		s.	d.	£.	s.	d.
Feb. 17.	4 Sacks of Coals, at	39	6	per Ch.		
Mar. 4.	5 $\frac{1}{2}$ Chaldrons of ditto,	30	0	—		
16.	8 Sacks of ditto,	34	6	—		
27.	9 Sacks of ditto,	42	0	—		
Apr. 6.	7 Sacks of ditto,	38	9	—		
20.	3 Sacks of ditto,	45	0	—		

£.

† T

(14.) THOMAS

(14.) THOMAS JOHNSON,

Bought of JOHN GROCER, June 27, 1784.

	C.	q.	lb.		s.	d.	£.	s.	d.
12 Hhds of Tobacco, wt.	6	1	24	at	53	6			
9 Barrels of Raisins,	2	3	20		39	8			
12 Ditto of Rice,	—	3	1	27	26	11			
8 Bags of Pepper,	—	1	3	14	79	6			
Brimstone,	—	3	2	24	27	6			
4 Hhds of Sugar,	—	4	1	17	33	9½			

 £.

(15.) Mr. JOHN MAN,

Bought of JOHN JEE, Aug. 27, 1778.

6 Casks of Barbadoes Sugar, at 2 Months credit, viz.

No.		wt.	C.	q.	lb.	q.	lb.
1.	—	10	0	24	Tare	3	10 each.
2.	—	9	2	17			
3.	—	8	3	20			
4.	—	11	2	17			
5.	—	10	1	1			
6.	—	9	3	19			

 Gross,
 Tare,

 Neat,

 at 53s. 6d. per Cwt.

(16.) Mr.

(16.) Mr. JOHN ROSS,

Bought of JOHN MACKINDER, Aug. 30, 1778.

	C.	q.	lb.	s.	d.	£.	s.	d.
3 Hhds of Sugar, Grofs	10	3	10					
Tare	0	2	10	at	74	0	p.	C.
2 Bar. of Scotch Snuff, Gr.	8	2	7					
Ta.	0	2	7	at	1	6	p.	lb.
2 Ditto of Pimento, Gr.	7	3	7					
Ta.	0	2	2	at	1	10		—
3 Ditto of Figs, Gr.	8	2	11					
Ta.	0	1	27	at	30	0	p.	C.
4 Hhds of Treacle, Gr.	11	2	19					
Ta.	0	2	27	at	14	10		—
3 Ditto of Prunes, Gr.	10	1	11					
Ta.	0	2	25	at	17	6		—

 £.

(17.) Mr. THOMAS BAIL,

Bought of JOHN SILVERSMITH, June 3, 1784.

	oz.	dwt.	gr.	s.	d.	£.	s.	d.
A Silver Tankard, wt.	14	2	3	at	6	9	per	oz.
— — — Punch Ladle,	0	19	20	at	7	2		—
— — — Punch Bowl,	24	1	7	at	7	6		—
A Pair of Silver } Sauce-boats,	40	11	10	at	7	10		—
6 Cruet Tops, —	4	9	3	at	6	4		—
2 Sauce-Pans, —	62	19	4	at	7	2		—
1 Doz. of Dishes, each	26	14	6	at	6	2		—
Ditto of Plates,	14	10	9	at	6	8 $\frac{1}{2}$		—

 £.

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